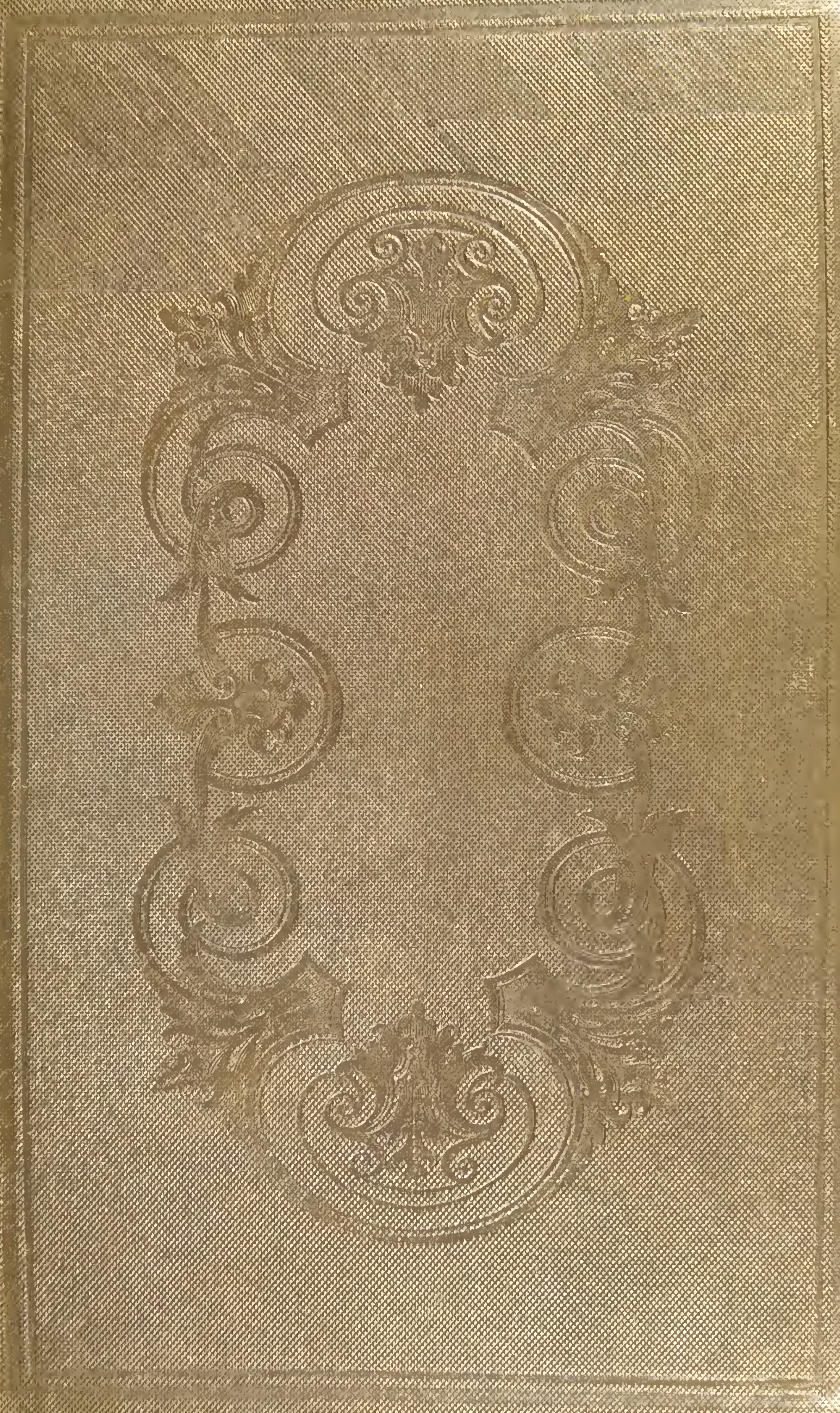

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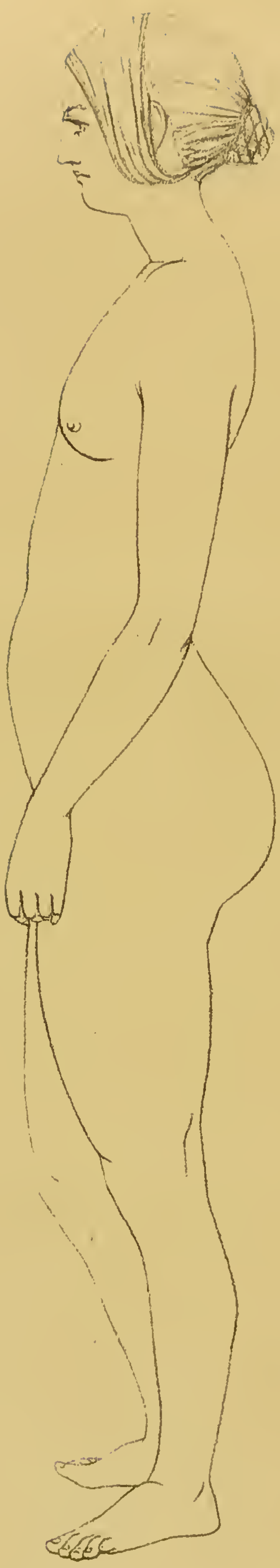

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DEFORMITIES
OF
THE SPINE AND CHEST.

CHAPTER I.

THE BONY STRUCTURE OF THE THORAX GENERALLY, AND THE SPINE IN PARTICULAR.*

The Chest.

THE more solid bases of the cavity of the thorax or chest, by which the form and position of the other parts are easily determined, or with which we find them in inseparable relation, consist of bones, cartilages, ligaments and tendons.

The bones of the thorax, which consist of ribs, vertebræ and breast-bones, are all bound together by cartilages, ligaments and tendons, so as to form a truncated cone, which has the apex turned upwards, and of which the axis passes through the breast.—See Figure I, which illustrates this, and many facts mentioned in this Chapter, and may therefore be referred to throughout.

---

* In this chapter, I have chiefly followed Soemmerring in the very minute description given of the osseous trunk in one of his minor works.

We must first, however, separately consider those pieces of which the cavity of the chest is constructed, in order more clearly and thoroughly to treat the rest and the form of the thorax generally.—We shall therefore describe these parts as seen in nature, in well formed, healthy persons, neither too old nor too young, or from 18 to 25.

The Ribs.

The number of the ribs is commonly twelve pairs, or twelve ribs on each side ; yet we not unfrequently meet with a pair more, above or below, and consequently thirteen.

If this supernumerary rib is above, then it more or less resembles the first rib, and is bound to the breastbone by a cartilage, or merely by a ligament; but still it is never perfectly like the first rib.—If, on the other hand, the thirteenth rib is below, then it is often so perfectly like the twelfth, as not to be inferior in strength; but the twelfth is in that case larger and longer than usual.

Sometimes we find a longish flat bone at the vertebra below the twelfth dorsal, which has an intermediate form between a thirteenth rib and the lateral process of the first lumbar vertebra, or passes as it were from a rib to a transverse process.

Even fifteen pairs of ribs may sometimes be seen in man.

Sometimes we see the opposite case, in which there is only eleven pairs of ribs; but then we find all of them broader and stronger than usual, for they form a thorax of the same circumference as the twelve pairs usually do.

Of the twelve pairs of ribs, seven usually are attached firmly by their cartilages gradually lengthening downwards, to the superior and inferior breast-bones, and are therefore called true ribs: the other five, or false ribs, gradually decrease in length downwards, in such a manner that the eighth rib by its cartilage still lies near the seventh, and the ninth near the eighth, while the tenth, eleventh, and twelfth do not touch by their cartilages.—There are also many cases in which eight ribs are attached to the breast-bone, and consequently there are only four false ribs.

All ribs, except perhaps the last, have a diagonal direction downwards, so that their posterior extremity lies higher than the anterior; but this inclination is different in different ribs.—Posteriorly, all the ribs make nearly the same angle with the vertebral column.

The first rib is generally the shortest, broadest, and roughest on its superior surface, and the strongest among the eight, considering its smallness: it has the longest and smallest neck, and is immoveably attached to the superior breast-bone by the shortest, hardest, but broadest cartilage, and in the least slanting direction.—The second, third, fourth, fifth, sixth and seventh ribs, as they descend, increase gradually in length, strength and obliquity.

The cartilage of the first rib descends towards the superior breast-bone, to which it is firmly attached.—The cartilage of the second rib runs almost horizontally.—From the third to the seventh rib, the cartilages gradually bend and ascend more, become longer, thicker, and increase in breadth upwards, terminating either roundly or angularly, and being proportionally turned in to the middle breast-bone.

Besides this, the cartilages of the fifth, sixth, seventh and eighth ribs are generally bound, though flexibly, to each other by a peculiar descending process of the cartilages lying above them; as the sixth by a process from the fifth, &c. Sometimes, only the cartilages of the sixth, seventh and eighth ribs are united in this manner, and sometimes those of the sixth, seventh, eighth and ninth. Sometimes three or four cartilages flow as it were into an undivided mass.

The eighth rib is altogether shorter than the seventh, but, considering only its bony part, it is the longest of all,—yet not the strongest, because, at its sternal extremity, it becomes somewhat thinner. It lies still more slantingly than the seventh. Its cartilage is weaker, shorter, more pointed than the cartilage of the seventh.—The ninth is much shorter than the eighth, and weaker in all its parts. Its cartilage is still more pointed. — The tenth and eleventh ribs are shorter and weaker, as well in their bony as their cartilaginous parts, and lie still more obliquely than the ninth. Their cartilages terminate less pointedly.—The twelfth rib is the shortest, weakest and flattest of all the false ribs, and terminates with the shortest, bluntest, or even a scarcely observable cartilage. It often lies not so slanting as the eleventh, particularly when uncommonly short.

Each rib, then, goes, at its sternal extremity, into a cartilage, which at this place has its form and thickness so completely, that we must regard it as a process of the rib, which never attains the length of the bony part.

The peculiar elliptical or sickle-formed bending of the ribs, is universal as regards the bony parts, so that the first rib is the most bent, and the rest even to the last, are always less bent, until the last appears to be little or not at all bent.

The ribs do not lie parallel, 1st, because their heads posteriorly are much nearer each other than their sternal extremities; 2ly, the cartilages of the five inferior true ribs anteriorly approach so much in ascending, that five or six lie close to each other; 3ly, they are not every where of the same breadth; 4ly, their mobility is different; 5ly, their edges becoming sharper as they descend forward, gradually lie more inward.

They do not leave spaces between them bounded by parallel lines. The space between the first and second rib is commonly of considerable breadth throughout; but the broadest of all is that between the second and third ribs. The following interstices on the whole decrease in breadth, to the two spaces between the last three ribs. This space between each pair of ribs is, between the true ribs, greater towards the breast-bone than in the middle or posteriorly. The longest is between the seventh and eighth pairs.

Owing to the increasing length, and to the great descent of the bony part and ascent of the cartilaginous part of a rib, united with a considerable interstice, and the mode of the anterior and posterior turnings, the 2d rib is more moveable than the first, the 3d more moveable than the 2d, the 4th more moveable than the 3d, and the mobility increases to the penultimate or last.

The first true rib cannot be raised without moving the breast-bone at the same time, because of its cartilage being immoveably bound to the sternum. The last rib is sometimes the least moveable of all, and makes, as it were a transition to the wholly immoveable lateral processes of the first lumbar vertebræ, and this partly on account of its short tight transverse ligament, partly on account of the great angle which it makes with the vertebral column, partly because of the square muscle of the loins attached to it.

The ribs, as we may prove by pressure in our own bodies, have considerable elasticity, which arises principally from their bowlike or hooplike and winding form, and from the small proportion which their thickness bears to their length.

It is well worth remarking, that the ribs belong to that part of the bony structure which is earliest formed, since besides those of the auditory organs, no bone is met with so perfect even in the unborn child.

The Vertebræ.

The ribs, in order to form the thorax, are fastened to a column, which consists of twenty-four separate vertebræ firmly articulated together by layers of fibro-cartilage lying between them, and which, in all well formed persons, is piled up in a straight line as viewed from before.

The number of the dorsal vertebræ, to which the ribs are attached, is like the number of these, various; commonly twelve, seldom either thirteen or eleven.

On the whole, these vertebræ, as they lie lower, increase regularly in height, breadth, thickness and roundness; as do the fibro-cartilages between them in thickness: therefore the fourth dorsal vertebra appears much more considerable than the first, the eighth more considerable than the fourth, and the twelfth more considerable than the eighth; and therefore the circumference of the inferior surface of each single vertebra, is greater than that of the superior surface.

Hence this column is somewhat conical, firm, secure, and strong enough to bear the weight of the head, chest and arms with ease, as well as capable of permitting the motions necessary to this burthen; capable indeed of enduring without danger a sudden and violent shock to this burthen, as in leaping.

This conical column is moreover bowed out posteriorly: so that the arch of the curve is directed outwards, and its greatest hollow falls almost opposite the inferior breastbone.

Sometimes this column swerves a little to the right in the region of the third, fourth or fifth vertebra, as Cheselden erroneously believed, to make more room for the heart; but generally in this case the spinous processes do not lie in a straight line.

In each of these vertebræ, we distinguish the anterior part or body from the posterior part or arch, which leaves, between it and the body, an opening for the spinal marrow; and, even in the arch itself, we distinguish seven processes, two lateral, four articulating, and one spinal.

We see how the form of the first dorsal vertebra, generally passes to the last cervical, and that of the last dorsal to the first lumbar.

If we wish to view the processes in the order of their strength compared with their bodies; then evidently the first dorsal has the strongest and largest processes in relation to the smallest body; and the twelfth dorsal vertebra has the smallest and weakest processes.

Very often we find the superior border of the body of a vertebra, not running parallel to the inferior, but the right half of the body observably higher; yet here we generally see, in cases where it is not caused by disease, the next body of a vertebra lying above or below, depressed in the same half. For example, if the right half of the second vertebra is higher (and its left lower) then the right half, either of the first or third vertebræ is lower (and its left higher).—Hence it is but seldom that we see the spinous processes form a perfectly straight line, but one goes to the right and the next above or below lies to the left of the straight line.—By this arrangement, the misformation of a single vertebra is so much improved, that it does not affect the straight ascent of the vertebral column as seen from before.

The ribs are formed first; the breast-bone, later; the vertebræ, last.

The fibro-cartilages between the bodies of the vertebræ, hold the vertebræ most firmly together, without impeding their mobility. Between the first and second, and between the second and third dorsal vertebræ, these fibro-cartilages are tolerably thick, but not so large in relation to their circumference, as between the following: they increase gradually in circumference and thickness proportionally with the bodies of the vertebræ, and consist of very elastic, cartilaginous, sinewy fibres.

The Breast-bones.

The three breast-bones close the middle and anterior part of the frame-work of the thorax, and are firmly bound together by thin plates of cartilage, yet are moveable on each other. The superior one is octagonal; the middle one longer, and ends bluntly below; the third is the smallest and thinnest, and ends in a pointed cartilage.

The breast-bones are so bound to each other, that, viewed laterally in connection, they present a shallow arch, elevated in front and hollowed behind.

They present also from before and behind, a body becoming, on the whole, more pointed downwards, which mostly becomes somewhat broader between the articulations of the fourth ribs, but soon decreases in breadth.

On the superior breast-bone, which is thicker, broader and stronger than the inferior, the first pair of ribs are attached close to the clavicle.—At the place where the superior and middle breast-bones meet, the cartilages of the second pair of ribs are attached; and the series concludes by the other cartilages as far as the seventh pair being fixed to the middle breast-bone.

Generally the cartilages of the first pair of ribs lie farthest apart from each other.—The last three or four pairs of true ribs are placed at less and less distances both in relation to the breadth and the length of the breast-bone, so that very often the cartilages of the seventh pair of ribs immediately touch.—The third or inferior breast-bone always is more inward, so that the cartilages of the last pair of true ribs coming together, partly cover it before.

Sometimes this happens in an almost regular relation; so that the distance between the cartilage of the first rib and the articulating surface for the cartilage of the second, is the greatest, the distance between the articulating surface for the second and the articulating surface for the third, &c. always become smaller, till the distance between the sixth and seventh cartilages is the least of all.

On account of the gradual lengthening of the cartilages of the true ribs, which are attached to the breast-bones, the end of the middle breast-bone extends often more than twice as far from the vertebral column as the upper one.

Still we never look at the sternum with a certain degree of care without finding it strikingly unsymmetrical, as well in the whole as in the parts.

The Cavity of the Chest.

We thus see that the thorax, composed of a frame-work of ribs, breast-bones and cartilages, is narrowest above; and then always widens downwards on account of the vertebral column arching backwards, the bowing out of the breast-bones, and the much greater distance of the inferior border of the inferior breast-bone, than of the superior, from the vertebral column; till, lower down, it always again contracts (though it still remains much larger than above) on account of the decreasing length of the false ribs, the projection of the thicker vertebral bodies, and the bending inward of the sternum at its inferior extremity: consequently, on the whole, it appears more conical than barrel-shaped.

We next see how, in this structure, by that projection of the spinal column which is formed of the bodies of the vertebræ, and to which the ribs contribute, the cavity of the breast is divided into two halves, a right and a left.

We see farther, that this cavity, on account of the ribs becoming flat in front, particularly of their cartilages, and on account of the breadth of the sternum, appears before to be somewhat depressed.—At the sides, they have the greatest and strongest elliptical arching. — Posteriorly, they indeed appear externally flatter than at the side; but internally the hollow here is often at both sides most strongly turned.

In some, the right cavity of the chest is, from the bending of the third and fourth dorsal vertebræ, more arched than the left, and therefore stronger and better adapted to the strength of the right arm: hence we feel that arm to be the stronger.

The space, which is contained in front between the cartilages of the last pair of true ribs, and the cartilages of the following three or four pairs of false ribs, in the middle of which the point of the inferior breast-bone passes down, and which is filled up merely by muscular fibres and skin, is triangular, though in height and breadth very different in different persons.

In the horizontal section of this cone of the thorax, the greatest surface would fall nearly in the region of the seventh or eighth rib; and it is consequently in the contraction or expansion of this region that the most considerable changes occur in regard to the increase or diminution of its contents.

This change in size of the cavity of the thorax, appears when the ribs are elevated by inspiration, so that the first ascends but little, the second follows it, the third on account of its greater mobility, ascends still more easily in comparison with the second than the second in comparison with the first, and so on to the twelfth are they always more easily drawn upward.

At the same time, the breast-bones become elevated and removed from the vertebral column: still their inferior part yields proportionally more than the superior. The place where the superior breast-bone unites with the middle one, bends itself at an angle, and thereby prevents the place where the heart lies, from becoming more widened.—Reversely, the ribs follow a drawing up of the breast-bones.

To a certain degree, this expansion and contraction of the thorax resembles the drawing up and contraction of a pair of bellows.

Sometimes the thorax, in the living person, is most suddenly and violently contracted into a narrow space, as after a quick complete expiration: here the ribs are as it were convulsively drawn under; e. g. in sneezing. — In both expansion and contraction, the change of the cavity of the thorax, is much less considerable behind than before, because the ribs turn but little in their posterior articulations, while their fore parts, together with the sternum, are considerably raised and removed from the vertebral column.

It is owing principally to the cartilages between the vertebræ, that the thorax, like the rest of the spine, is shortened by long standing and again lengthened by lying long on the back; for these cartilages become each a little compressed by the weight of the body, which presses on the vertebral column during the erect position, and the height of the vertebral column is very perceptibly diminished, particularly in young persons. But in lying horizontally, they become repossessed of as much moisture and elasticity, as they lost during standing up, and consequently the former length of the vertebral column is restored.—Man, in his younger years, is therefore visibly shorter in the evening, and taller in the morning after rest.—Consequently here, in one case also the thorax becomes wider, and in the other narrower.

The cartilages between the vertebræ are also the causes why the vertebral column may be bent most forward and backward, less sidewise or to the right and left, and in all possible oblique directions between these four principal ones.

The vertebral column must often yield from its straight direction, in order to balance the weight of the body. Thus, if we stand more on one foot than on the other, and throw the weight of the upper part of the body to the other side, the vertebral column must bend, and its arching be directed toward the opposite side.—At the same time, the ribs of the side of the now supporting foot are somewhat pressed together, while those on the other side, are separated from each other.—Consequently the thorax is also contracted on the side where the ribs approach each other; and it is expanded on the other, where they are separated. This we see plainly in Figure I, which rests on the right foot.

On the whole, the thorax appears tolerably symmetrical, and consequently the right half to resemble the left: but we must not understand this exactly; for we often find one side more strong, more roomy, and also a little differently formed; e. g. more vaulted, or flatter, than the other, without original malformation or any deformity produced by illness. Still nature makes this almost imperceptible, or at least harmless, by a little alteration on the other side. This is most striking in the ribs: we but seldom find a right rib exactly similar to the left rib lying opposite it: in a word, we never see a perfectly symmetrical thorax.

Union of the Thorax with the Arms.

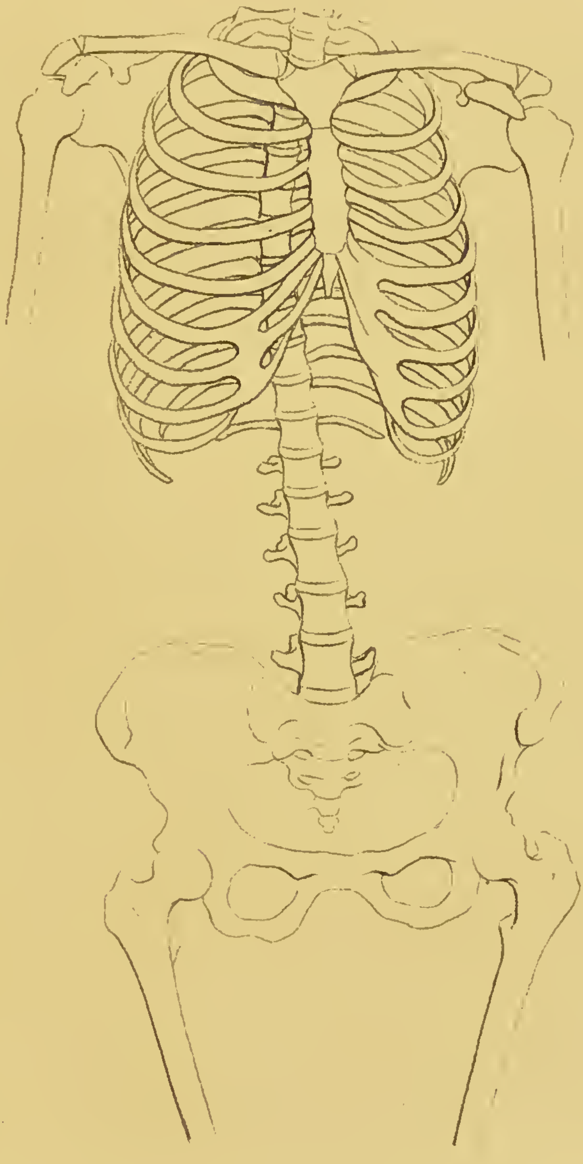
The arms are so placed on the thorax, that the angle formed by the clavicle and shoulder blade, below which the arm hangs, at the same time completes the upper part of the thorax, and covers it from above downward.

The clavicles come so near to each other, that they are at the same time bound to each other, and firmly articulated to the superior breast-bone by a short strong ligament.

The shoulder-blades, covered with muscles, fit

Skeleton.

No 1.



with their hollows the elevation of the thorax likewise covered with muscles, and play freely and easily in the space from the first to the ninth rib, upward and downward, and inward and outward, between the spinous processes of the vertebral column and the bend of the ribs, and in all directions between these.

From this it appears, that no change of the form of the skeleton of the thorax can occur at the place where the shoulder-blades lie, without at the same time throwing them out of their position. For instance, if the fourth and fifth ribs are pressed upwards at this place, they push the shoulder-blade upward with them, and consequently also the arm, &c. If the second, third, fourth, fifth or sixth ribs are pressed outwards posteriorly, the shoulder-blades must naturally follow.—On the other hand, a pressure inward must alter the shoulder-blades and eventually the form of the ribs, and thereby also the thorax.

The muscles which lie between the bones of the thorax and the clavicles, shoulder-blades and arms, move sometimes the upper arm toward the thorax; sometimes the thorax toward the upper arm; sometimes both at once toward each other.

In the same manner as an expansion or contraction of the thorax draws the upper part of the arm out of its place, the strongly and often moved shoulder gradually draws the superior part of the thorax out of its place.—Hence we find, that in hair-dressers, who constantly use the comb with one hand only, and hold the hair steady with the other, the thorax on the active side is raised by the constant action of the muscles of the shoulder, so that it must lie higher than the opposite inactive shoulder-blade.—In common language, we call this a high shoulder; but it is in fact a true hump.

It is known that one arm is commonly longer, thicker, heavier and stronger than the other. Therefore, in equally strong halves of the thorax, the action of its weight, its pressure and its muscular power, is different on its side of the thorax, from the action of the weaker arm on the other.

In front of the space between the second and fifth ribs on each side, lie the breasts or great milk glands on the muscles under the skin.

Contents of the Thorax.

In this frame-work formed by ribs, vertebræ, breast-bones, cartilages and ligaments, whose space is filled up by muscles and tendons, the inside covered by a thick membrane, the base formed by the diaphragm, while over the whole is a covering of external skin, we find in man:—the lungs, which occupy beyond comparison the greatest space; the heart; the origin of all the arteries, veins and absorbents, with their glands; many nerves; the wind-pipe; the gullet; the thymus gland, with the accompanying fat which lies like a soft pad on the ribs, between their periosteum and the diaphragm, or about the heart, or in the partition or the parietes of the chest.—See Figure II.

Moreover, this cavity receives below, the liver, stomach and the kidneys, besides different portions of the intestinal canal. Indeed this frame-work, by its union with the muscles of the abdomen and loins, and the undivided passage of its general covering to the lower part of the body, has a great share in the formation of the cavity of the abdomen, and the greatest influence on the intestinal canal and every-thing else contained in that cavity.—See Figure III.

As the abdomen, on the inside, is separated by nothing from the pelvis, the organs of generation, and the ureters lying in it, it must be evident, that no change of the cavity of the thorax can occur without at the same time changing the cavities of the abdomen and pelvis.—It appears, that, on the other hand, no change of the cavity of the abdomen and pelvis takes place without at the same time changing the cavity of the thorax.

Lastly, as the arteries and veins of the thorax and abdomen stand in evident relation to those of the head, so can no considerable alteration of the cavity of the thorax or abdomen occur without at the same time interfering with the cavity of the head.

Thus is all that is necessary to the life, preservation, and reproduction of man brought about in the most wonderful dependence.

Difference between the Male and Female Thorax.

As yet we have described the properties of the thorax in so far as they are common to both sexes; whence all that has been said here is applicable to both. In order, however, to explain certain phenomena, we must sketch the visible differences in the well formed skeleton of each sex.

We must not indeed expect to find every characteristic in every skeleton of a woman or man: it is enough when, by the greater number of these, it appears exactly what the case is, when we compare proportionally perfect female forms with proportionally perfect male ones.

That proportionally all the bones of the body of a woman, and consequently also the bones of the thorax, are, in comparison with those of a man generally smaller, weaker, thinner, smoother, later formed, and, we may almost say, finer fibred, is already known.

The general remark, however, has been made, that, when a woman's bone is the same length, and, at its ends, where it joins other bones, of the same circumference with a man's, the mass of bone lying between these appears to be of less circumference, thinner and smaller.

Ribs of Woman.

The ribs of woman are, 1. thinner, than those of man, and, in delicately formed women, almost semi-transparent; 2. they are less arched, as well on their inner surface as their outer; therefore, 3. their upper and under edges are sharper; 4. the smaller bow of their sickle-form, is, in relation to the greater, a segment of a smaller circle, and therefore the vertebræ turn deeper in towards the breast, and a rule laid posteriorly on the right and left, seventh and eighth true ribs, in general does not touch the spinous processes at all; 5. at the place where the extensors of the spine lie, and produce a rough oblique line, they appear more angular; 6. almost from the third rib, they appear more bent, particularly if we lay them singly on a flat surface; 7. the sternal extremities do not increase so much in breadth; 8. they have proportionally much longer and weaker cartilages; 9. on account of all these properties taken together, they are more elastic than those of men, and are more easily bent; 10. the gradual decrease of the false ribs in length downwards, from the eighth to the twelfth follows much more suddenly, or in a greater degree in proportion; 11. we find, therefore, that, though in the male sex, the last rib exceeds or equals the first in length, this is not the case in well formed women, where the last rib is mostly much shorter than the first; 12. several of these single circumstances taken together show, that the ribs, particularly the lower ones, must be on the whole more moveable; 13. in some dissections, the third and fourth ribs appear somewhat drawn down and flattened, from the pressure of the breasts or milk glands: still this is not found often enough, to be stated as general.

Vertebræ of Women.

The vertebræ of women appear—1. higher in proportion to their breadth, than those of men, for if the last dorsal vertebra in the female measures eleven lines in height, and an inch in the male, then in the female it is an inch and a line broad, and in the male an inch and six lines; 2. they exceed still more in their circumference, particularly at the sides; 3. their lateral processes are more strongly bent backward, and therefore make the furrows which run between them and the spinous processes on each side along the back, deeper; 4. the spinous process is sharper; 5. it is shorter; 6. it descends more; 7. the hollowing posteriorly of the vertebræ for the spinal canal is greater; 8. therefore the whole canal is more roomy; 9. the lateral openings of the canal, in which lie the nerves and blood-vessels, and which are formed between the arches proceeding from the bodies of the vertebræ and the vertebral bodies themselves, commonly between every two, though always more from the upper of such vertebræ than from the lower, are much wider; 10. on the whole, therefore, each single vertebra confirms the general observation made above on the bones of women—that, if the two articulating surfaces of the bodies of the vertebræ, which are united by the cartilage lying between, as well as the four articulating surfaces for the ribs, and the four articulating surfaces on the oblique processes, consequently all the articulating surfaces, of a woman's vertebræ have the full spread of a man's, then the mass of bone lying between them appears smaller.

The Breast-bones of Women.

A considerable difference is found constantly between the breast-bones of women and those of men in regard to their proportion to one another; so that, in by far the most cases, it may be determined to which sex they have belonged. Indeed, in many persons who are not too fat, we may, even during life, as well as by the most beautiful antique statues, be convinced of the truth of these observations. Still it must be recollected that we here speak of a well-formed female thorax.—1. The upper breastbone is, in proportion to the middle one, much greater in the female sex, than in the male; very often so great, that its length is not by a great deal contained twice in the middle one: on the other hand, in the male sex, the middle breast-bone mostly exceeds the upper one twice, or more in length. 2. The upper breast-bone mostly appears stronger in proportion to the middle one. 3. This we find even from the earliest youth, sometimes even in the embryo. 4. We find the point of the middle or inferior breast-bone, like the upper one, smaller, but, in the upper part, as perfect as in the male sex, formed of osseous substance, and often early, or before the formation of the other bones, united with the middle breast-bone in one single piece. 5. They are generally shorter in proportion to the ribs. 6. The inferior border of the middle breast-bone falls immediately in the horizontal line between the deepest points of the fourth pair of ribs. 7. If, in the breast-bones of a woman, the middle one be so long that it is twice as long as the upper one, then the upper one is unusually small; so if the upper breast-bone of a man is not contained twice in the length of the middle one, we find it uncommonly small.

The Clavicles of Women.

The clavicles of women appear to be straighter than those of men, in order that the shoulder-blades may expand, proportionally to the broad hips, and be brought properly backward. In the male sex, on the other hand, they are more bent, to bring the scapulæ more forward than would be the case if they were straighter, because they determine the distance of the scapulæ from the superior breast-bone, like the beams called sleepers; and their bend in the male sex answers better the form of the thorax.

They appear straightest in ladies who have grown up accustomed to stays.

The Thorax of Women.

In so far as these parts contribute to the thorax, we find the following differences between the two sexes. On the whole, the thorax of women is far more barrel-shaped than that of men, and appears altogether rounder. The spinous processes do not project so much behind; 1. because of the ribs being bent posteriorly; 2. because of their weaker points; and 3, on account of their more strongly bent back lateral processes. The section between the cartilages of the seventh, eighth and ninth ribs forms, in the direction upwards, a much more pointed angle. The whole thorax, notwithstanding it is longer, still ends proportionally higher above the edge of the os pubis, on account of the shorter breast-bones, the higher lumbar vertebræ, and the spinal column not sinking so deep between the hips: therefore the whole body of women is longer and narrower. The distance from the little head of the last rib to the border of the hip-bone is greater, partly because, in the lumbar vertebræ, with proportionally smaller breadth, the height is more considerable, and partly, because the lowest lumbar vertebra lies almost at the same height with the edge of the hip-bone, whereas in the male sex it often sinks deeper between the hip-bones. The upper part of the thorax appears proportionally wider about the region of the fourth rib, but generally narrower below. We also find, that commonly, in well-formed men, when stretched out on a horizontal surface, the breast is elevated considerably higher than the prominence of the os pubis; in women, on the contrary, the breast is not higher than the os pubis, and is sometimes rather lower. All this we may with pleasure see confirmed by a comparison with the most beautiful antique statues of men and women.

Certainly by this arrangement, the thorax of women is better adapted for change during pregnancy. The bony and cartilaginous skeleton yields more easily to the viscera which are pressed up by the expanding uterus, because all the ribs are weaker, flatter, more elastic, furnished with longer cartilages, and more mobile, because the false ribs are also, though gradually, considerably shorter, because the vertebræ are higher and less broad, the whole column therefore more slender, the lateral openings in the spinal canal wider, and the sides of the vertebræ more sloped,—especially because the breast-bones are shorter, and the point of the inferior breast-bone ends higher, and with more cartilage, and because the whole thorax is longer, rounder and more raised over the pelvis.

That the breasts or milk glands of women, in mature age, are larger, more prominent, more perfect, than those of men, and, in regard to the thorax, occupy a greater space, and stretch themselves almost from the second to the fifth rib, is too well known to be dwelt on here.

CHAPTER II.

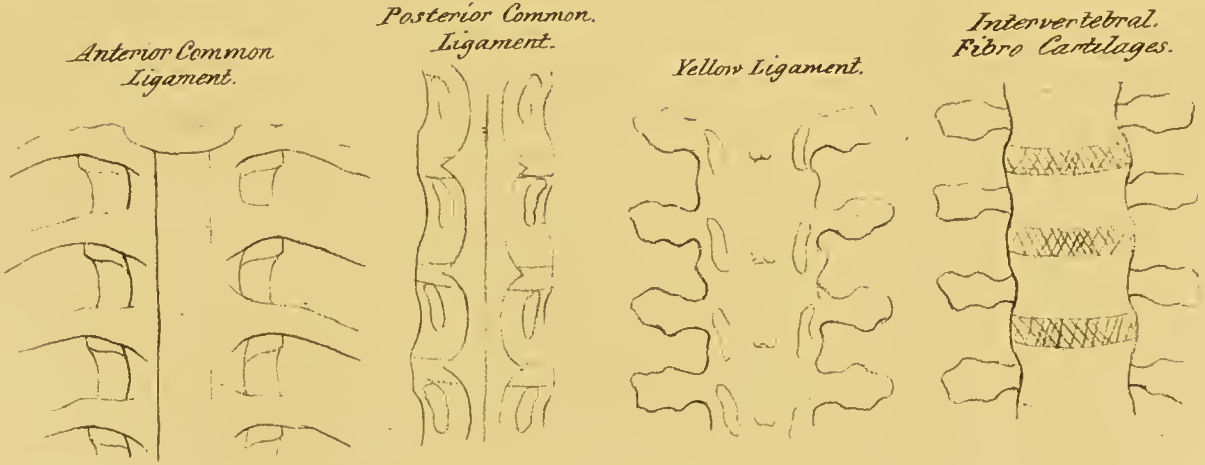
THE LIGAMENTS OF THE SPINE, &c.

The spine, although capable of bending in all directions, is yet so very secure, that it is more easy to break than to dislocate it. From the third cervical to the last lumbar vertebra inclusive, each is placed by its body and its articular processes, in contact with that which precedes it and that which follows it; while the laminæ and spinous processes of all the vertebræ are also connected by LIGAMENTS. Their articular processes are likewise greatly strengthened by accessory ligaments. Each vertebra has moreover distinct and peculiar means of union, as the fibro-cartilages, and the yellow ligaments, and it participates in the support of common ligaments which extend at once over the whole or the greater part of the column, such as the anterior and posterior vertebral.—See Figure IV. &c.

The *Intervertebral Fibro-cartilages* exist between the bodies of the vertebræ, from the interval between the second and third to that between the last and

Ligaments.

4.


Anterior Common Ligament.
Posterior Common. Ligament.
Yellow Ligament.
Intervertebral. Fibro Cartilages.

the sacrum. Their form corresponds with that of the bodies of the vertebræ, between which they lie, being oval in the neck and loins, and circular in the back.

It is important to observe that the fibro-cartilages of the neck and upper part of the back, are much thinner than those of the lower part of the back and those of the loins, the latter having a thickness of half an inch. But each fibro-cartilage is not of equal thickness throughout: in the loins and neck, they are thinner behind than before, and they are the reverse in the back; and this constitutes one of the principal causes of the triple curvature of the spine.

By their surfaces, the fibro-cartilages closely adhere to the surfaces of the vertebræ above and below. In persons not exceeding twenty-years of age, they are so firmly united to the vertebral epiphyses, that they are easily detached along with them. Their circumference corresponds before to the anterior vertebral ligament, and behind to the posterior, having strong adhesions to the fibres of these. They contribute to form the intervertebral foramina, and in the back, help to form the small articular cavities which receive the heads of the ribs.

These intervertebral fibro-cartilages, which resemble sections of cylinders, firm, flexible and of whitish colour, are formed at their circumference by very close fibres and laminæ of ligamentous nature.

These fibres never pass perpendicularly from one vertebra to another: on the contrary, the outermost ascend obliquely, and cover other layers, of which each has an opposite direction to that which lies over it. The concentric laminæ are numerous anteriorly and laterally, but fewer posteriorly: they intersect, become thinner, and leave between them wider intervals as they approach the centre. Their vacuities are filled with a soft pulpy viscid substance, of greyish colour, and, at the centre, there is only a soft spongy and elastic areolar tissue, supplied with this viscid substance: this structure is much more apparent in the lumbar region than in any other. In children, this substance is whitish, transparent, and less abundant than in adults, in whom it is more consistent and of yellower colour. In the old, it again diminishes in quantity, and each layer loses much of its thickness.

The *Yellow Ligaments* occupy the interlaminar vertebral spaces, from that between the second and third to that between the last and the sacrum, and they thus complete the vertebral canal behind. They are more apparent within, than without the vertebral canal, and each is divided into a right, and a left portion, angularly united toward the base of the spinous process, so as to leave between them a small fissure, closed only by cellular tissue. At the upper part of the neck, they are thin and narrow; they become thicker and broader as they descend; and, in the loins, they have considerable dimension. They are a strong, firm, elastic, tissue of yellowish colour and composed of vertical fibres.

The *Common Anterior Ligament* extends over the fore part of the vertebral column, from the Axis to the upper part of the Sacrum. It is very narrow in the neck, broader in the back, still broader in the loins; and it covers the greater part of the bodies of the vertebræ. It is thin in the cervical and lumbar regions, and thicker in the back; and it everywhere follows the inequalities of the vertebræ, accommodating itself to all their elevations and depressions. In structure, it is membraniform, of glistening appearance, and very distinctly striated longitudinally, its striæ separating into bundles of fibres, between which are small intervals, irregular in form and place, for the passage of blood-vessels and cellular tissue.

The *Common Posterior Ligament* is connected at its upper part, with another named the occipito-axoid. It extends over the back of the bodies of the vertebræ, within the vertebral canal, from the axis to the sacrum. It is broader in the neck and back than in the loins, where its breadth is not, at any part, more than two lines: it is broader opposite each layer of intervertebral substance than on the vertebræ themselves, and this gives it the form of a long band contracted at intervals. It is in general more compact than the anterior ligament;

rather thin in the cervical and lumbar regions, and thickest in the dorsal one. It is smooth and of shining pearly white colour; and it does not, like the anterior ligament, present distinct bundles of fibres or intervals for the passage of vessels.

The *Interspinal Ligaments* occupy the spaces between the spinous processes of the back and loins, but do not exist in the neck, where in place of them are muscles of the same name. They resemble so many small membranes, whose form varies with the space they occupy, so that they are narrower in the back, and broader in the loins. They are stronger and thicker, the lower their situation. Their lateral surfaces, on either side of the mesian line, correspond to the erector muscles of the spine.

The PURPOSES OF THE SPINE.—The spine, thus combining lightness with solidity and flexibility, supports the head and chest. It lodges and protects the spinal marrow and the membranes which cover it. It gives passage to the spinal nerves and to many vessels. Both anteriorly and posteriorly, it affords insertion to numerous muscles and ligaments. It is the centre of all the motions of the trunk, of which it transmits the weight to the pelvis.

The SHOULDERS, so closely connected with the parts we have described, ought to be of the same height: their upper part ought to correspond to the level of the first rib, and the acromion to the joining of the collar bone with the sternum; their internal posterior or spinal borders ought to be sufficiently near each other, to follow the direction of the spine of the back, making, when the arms hang by the sides, only a slight projection; and both shoulders ought to be equally rounded and projecting.—In this state, the collar bones are directed obliquely from within outwards and backwards, and from below slightly upward, the upper part of the chest being its widest part.—Lastly, when the end of a ribbon, with a weight attached inferiorly, is applied to the crown of the head, it ought to touch every one of the spinous processes of the vertebræ, which, even if they are hid under the soft parts, a slight inclination of the body will cause to project sufficiently to be distinguished; and this ribbon ought to fall perpendicularly upon a line resting on the hips on each side.

The central point or middle of the body in a well shaped woman, ought to correspond anteriorly to the superior part of the pubis, or posteriorly to the articulation of the coccyx with the sacrum, denoted externally by the bony projection formed at the point of union.

CHAPTER III.

THE MUSCLES OF THE SPINE, &c.

All the pieces composing the vertebral column are but slightly moveable one upon another; yet, on account of their number, the general motion is both sufficiently extended and varied. This flexibility of the spine is absolutely necessary for our movements.

The osseous prolongations formed by the spinous and transverse processes of the vertebræ, which give attachment to muscles and ligaments, serve further to bind the vertebræ closely to one another, and allow greater facility for the precise direction of the movements. By the arrangement of these processes, the lumbar motions are much confined laterally, whilst they have a more extended movement from behind forwards; in the dorsal region, the lateral movements are, on the contrary, more extensive than those from before backwards; and, in the cervical region, the rotatory motion of the vertebræ is more easy than any where else.

In illustration of the Muscles described in this chapter, see Figures V. to XI. inclusive.

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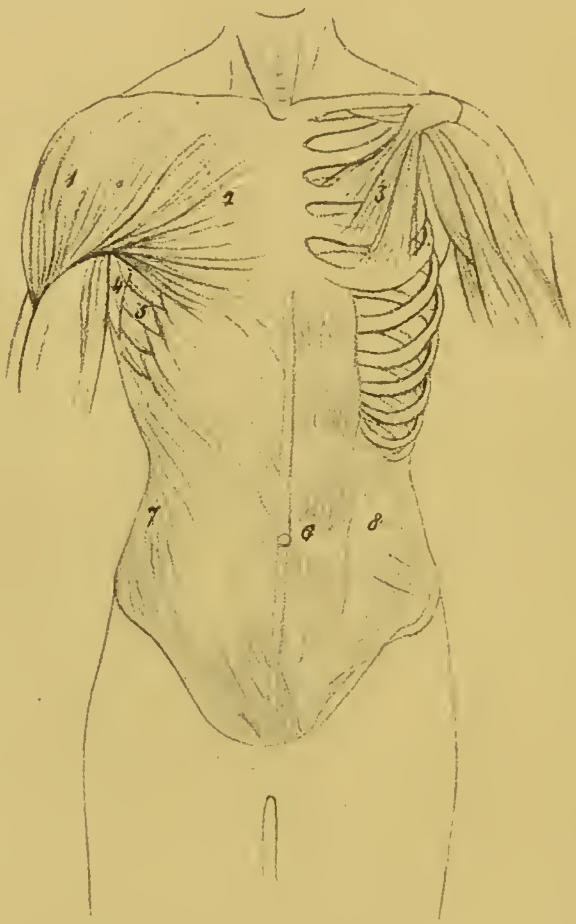

Muscles.

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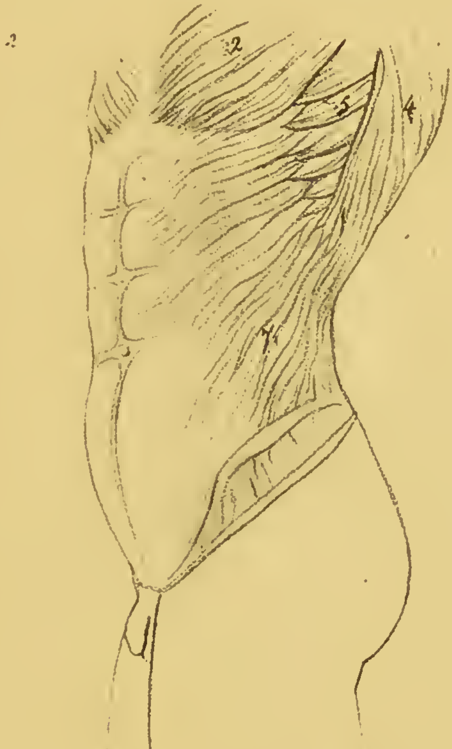


Muscles.

Muscles of the Shoulder.

The *Great Pectoral Muscle* arises from the inner or sternal part of the clavicle, the anterior surface of the sternum, and the cartilages of the 3rd, 4th, 5th, and 6th true ribs. The upper or clavicular fibres descend, the middle or sternal pass horizontally, and the costal or inferior ascend obliquely, outward. They are inserted into the anterior and upper third of the arm. The muscle either moves the arm, or, by acting on the ribs, contributes to respiration.—When the arm hangs by the side, this muscle carries it inwards and forwards; when the arm is raised, it lowers it; and when the arm is rotated outwards, it rotates it inwards. Its superior fibres alone can raise the arm slightly: its lower fibres can depress it and also the top of the shoulder.—When the arm is fixed, it acts upon the thorax, drawing the ribs and sternum upwards, and being thereby a muscle of inspiration. It can also raise the trunk upon the limbs as in the act of climbing.

The *Lesser Pectoral* arises from the 3rd, 4th, and 5th ribs (sometimes from the 2nd) externally to their cartilaginous portions. Its fibres pass outwards and backwards. It is inserted into the upper and inner surface of the coracoid process of the shoulder blade It draws the shoulder forwards and downwards, and carries the lower angle of the scapula backwards.—

It is capable of acting upon the ribs in the same manner as the former.

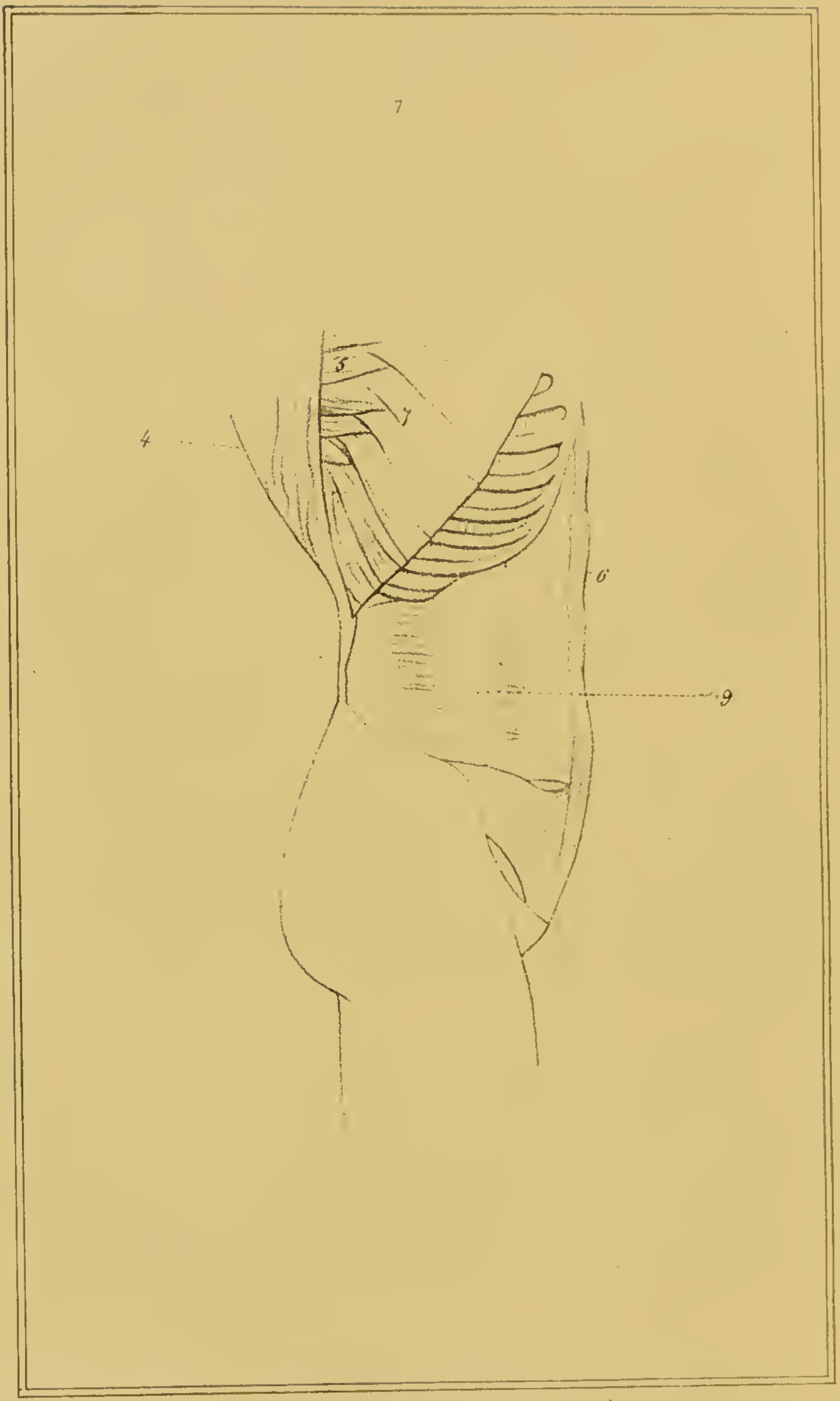
The *Subclavian* arises from the cartilage of the 1st rib. It ascends outwards and backwards. It is inserted into the external half of the inferior surface of the clavicle. Its use is to draw the shoulder and clavicle downwards and forwards;—and, by a contrary action, it raises the 1st rib.

The *Great Serrated Muscle* arises, by digitations, from the 8 or 9 superior ribs. Its fibres ascend obliquely backwards. It is inserted into the base of the scapula at its inferior and superior angles. Its use is to draw the scapula forwards, and, by thus rotating it on its axis, to raise the shoulder joint.—When the upper extremity of that bone is fixed, it draws the ribs upwards and outwards.

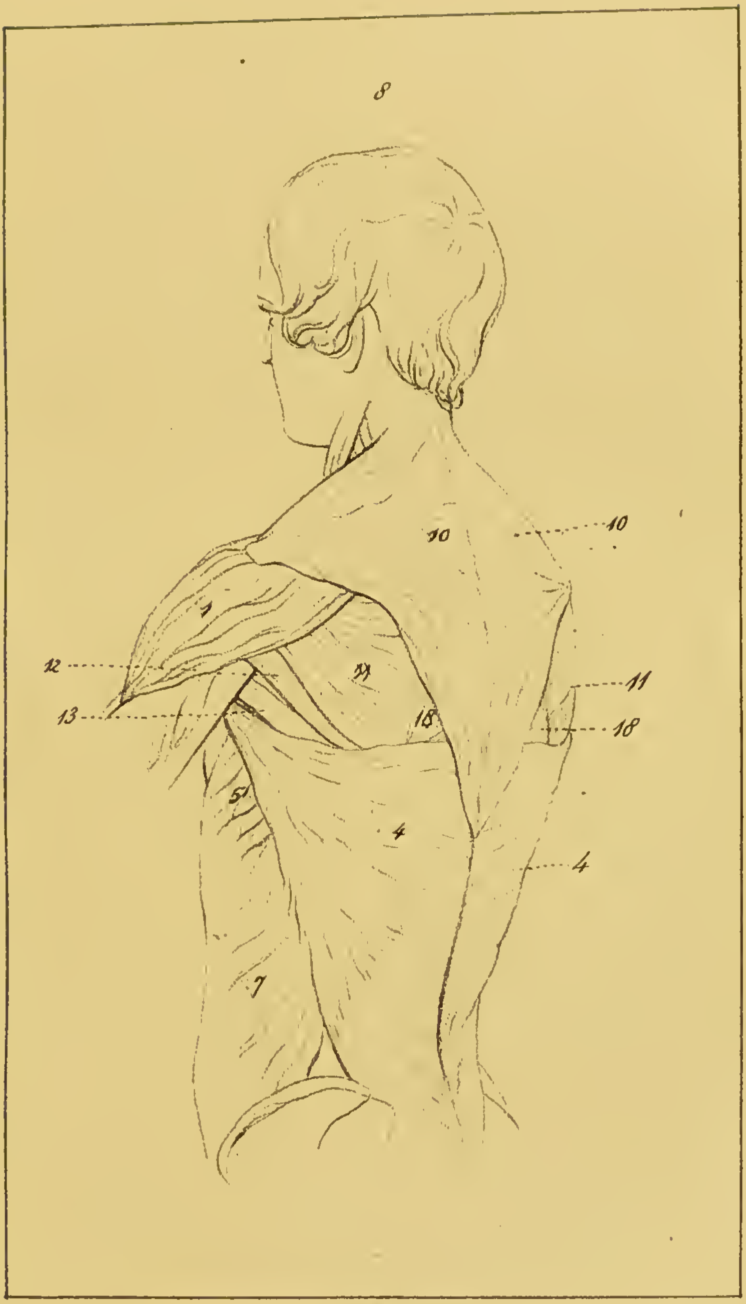
The *Deltoid* forms the top of the shoulder. It arises from the lower edge of the spine of the scapula, anterior edge of the acromion process, and external third of the clavicle. From these origins, the fibres pass towards a point. It is inserted into the outer side of the arm just above its centre. Its principal use is to raise the arm.

The *Supra Spinal* arises from the whole of the scapula above its spine, or the supra-spinal fossa. The fibres pass forwards. They are inserted into the upper and fore part of the arm. Its use is to assist the deltoid in raising the arm and abducting it.

The *Infra-spinal* arises from the inferior surface of



Muscles.



Muscles.

the spine of the scapula, and from its dorsum as low down as the posterior ridge, or from the infra-spinal fossa. The fibres converge forwards. It is inserted by a tendon just below the former. Its use is to assist the deltoid in raising the arm and in rotating it outwards.

The *Smaller Round Muscle* arises from a depression between the two ridges on the inferior edge of the scapula. It passes obliquely forwards and outwards. It is inserted into the arm immediately below the former muscle. Its use is to co-operate with the infra-spinal.

The *Subscapular* occupies the inner side of the scapula. It arises from the whole of the hollow of the scapula. It runs upwards and forwards. It is inserted into the internal or small tubercle of the arm. When the arm is in any direction separated from the body, the subscapular draws it toward it; it can also turn it inwards; and, when raised, it depresses it.

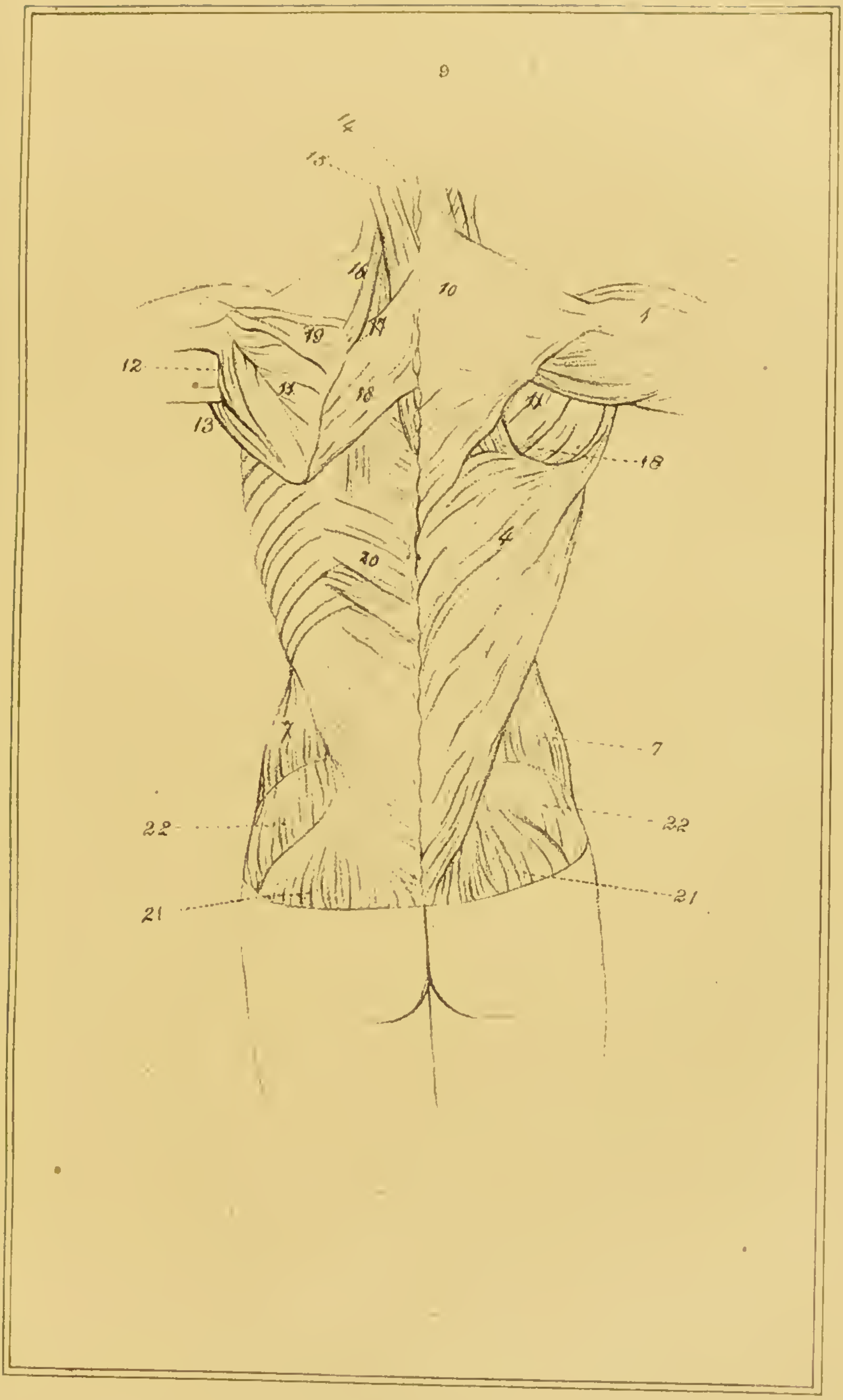
The *Greater Round Muscle* arises, below the infra-spinal, from a rough surface on the inferior angle of the scapula. It ascends forwards and outwards. It is inserted into the inner and posterior edge of the groove on the fore part of the arm. It rotates the arm inwards, and opposes the action of the infra-spinal and Smaller Round Muscle.

Muscles of the Back.

1st Layer.—The *Trapezoid* arises from the internal third of the superior transverse ridge of the occipital bone, the ligament of the nape of the neck, and the spinous processes of the seventh cervical and all the dorsal vertebræ. Its fibres all converge. It is inserted into the posterior border of the external third of the clavicle and of the acromion, and into the upper edge of the spine of the scapula. When both muscles act, they carry the scapulæ backward and toward each other: when the whole of one acts, it carries the shoulder and clavicle backwards.

The *Broad Muscle of the Back* arises from the six inferior dorsal spines, and from all the lumbar ones, from the back of the sacrum, the posterior third of the crest of the ilium or haunch-bone, and the three or four last ribs near their anterior extremities. It ascends obliquely outwards over the Smaller Round Muscle, and turns beneath this muscle to its fore part. It is inserted into the inner or posterior edge of the groove in the arm. Its use is to depress the shoulder and arm.—When a person is suspended by the hands, it lifts the trunk upon the arms.

2d Layer.—The *Rhomboid* arises from the lower part of the ligaments of the nape, and the spinous process of the last cervical, and of the first four or five dorsal vertebræ. It is inserted into the base of



Muscles

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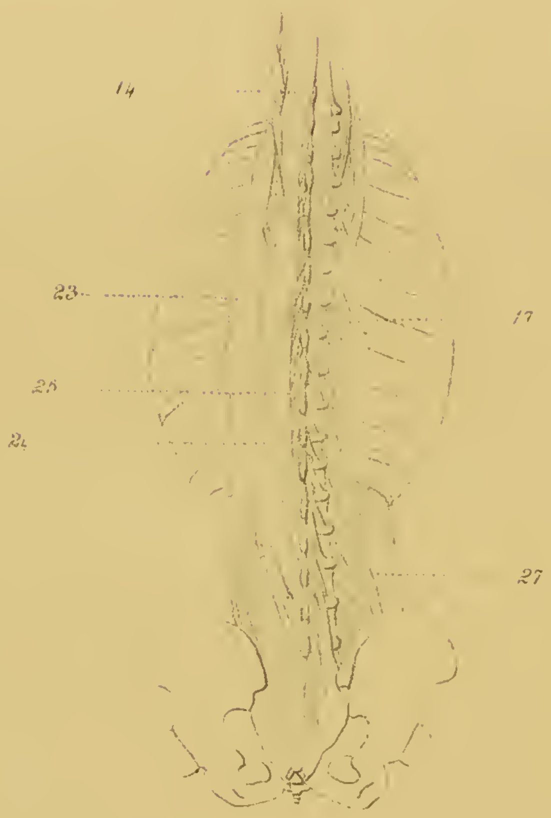


Muscles

the scapula. Its chief action is to bring the scapula toward the trunk: it also lowers the top of the shoulder.

The *Lifter of the Angle of the Scapula* arises from the transverse processes of the four or five upper cervical vertebræ. It is inserted into the base of the scapula. Its use is to raise the angle of the scapula, and thereby depress the top of the shoulder.

The *Superior Posterior Serrated* arises from two or three spines of the dorsal vertebræ. It is inserted into the second, third, and fourth ribs external to their angle. Its use is to expand the thorax by elevating the ribs and drawing them outwards.

The *Inferior Posterior Serrated* arises from the two lower dorsal spines, and two upper lumbar ones. It is inserted into the lower edge of the four inferior ribs anterior to their angles. It lowers the ribs, and thus contributes to expiration.

3d Layer.—The *Sacro-lumbar* arises from the posterior third of the crest of the ilium, the transverse and oblique processes of the lumbar vertebræ and other minor origins. It ascends, and is inserted into all the ribs near their angles. Its use is to extend the spine and bend it a little to one side, and to depress the ribs.

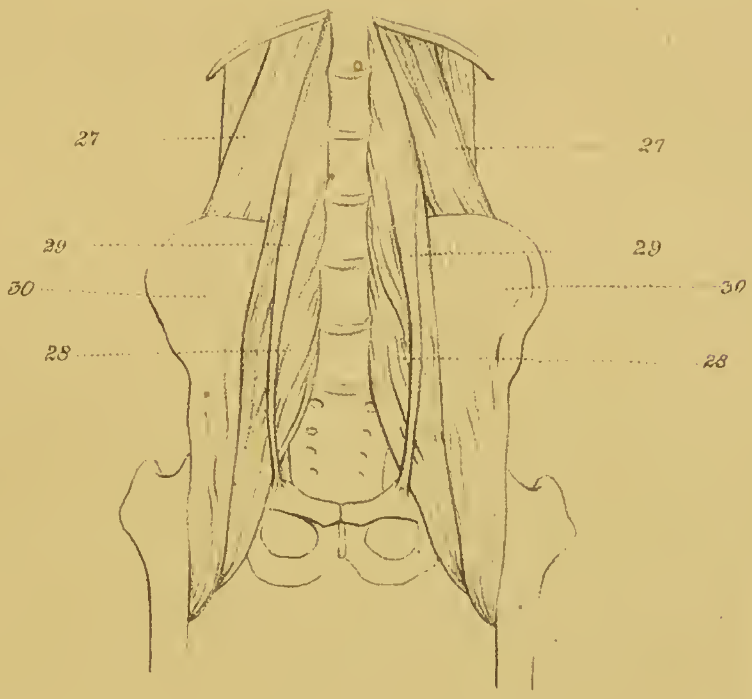
The *Long Muscle of the Back* lies internal to the sacro-lumbar. It arises from the same points. It ascends along the vertebral column. It is inserted into all the dorsal vertebræ, and into the ribs between their angles and tubercles. Its use is to extend, bend to one side, and support the spinal column.

The *Spinal of the Back* lies between the spine and the Long Muscle of the Back. It arises from the two superior lumbar and three inferior dorsal spines. It ascends close to the spinal column. It is inserted into the nine superior dorsal spines. Its use is the same as that of the Long Muscle of the Back.

4th Layer.—The *Semi-spinal* of the back arises from the transverse processes of the dorsal vertebræ, from the fifth to the eleventh. It is inserted into the extremities of the two inferior cervical and three or four superior dorsal vertebræ. Its use is to incline the spine backwards, and to one side.

The *Multifid of the Spine* consists of a series of small tendinous and fleshy bundles. The first arises from the Axis or second vertebra. It descends obliquely outwards. It is inserted into the transverse process of the third vertebra. And so the succeeding muscles are attached, running obliquely from vertebra to vertebra, between their spinous and transverse processes.

The last two muscles have nearly similar actions to the preceding three, and also some peculiar to themselves. When erect, they balance the vertebral column upon the pelvis; and by acting on one side, they produce a slight lateral inflection and a rotation of the vertebral column.



Muscles.

PART II.

KINDS AND CAUSES OF DEVIATION.

CHAPTER I.

GENERAL.

If nothing oppose the natural development of the vertebræ, the normal curves, which are not in existence at birth, gradually show themselves with age, and especially when children are able to walk, and the vertebral column assumes its proper directions.

This direction, however, may be altered in many ways, from a great number of causes, and under circumstances apparently different, especially between the age of eighteen and twenty.

Composed of pieces, solid, but moveable on one another, by means of an elastic and yielding substance interposed between them, called into action in every direction by forces variable in their intensity and mode of action, the vertebral column may be altered in form in various ways: these deviations take place,

1. When an organic alteration developed in the bodies of the vertebræ, destroys or softens them, in such a manner that they sink under the weight which they should support.

2. When the bodies of the vertebræ being otherwise healthy, any external force exercises a continual pressure on one side of the column, diminishes by degrees the thickness of the intervertebral cartilages, and even that of the bones on that side, whilst on the contrary the other side increases in thickness, owing to its not being compressed and absorbing itself alone the materials of nutrition, whence results an inequality in the surfaces of the bodies of the respective vertebræ.

Considered then in relation to their first causes, we may divide the irregularities of the vertebral column into two kinds:—

1. Those which have their seat in the vertebræ themselves;

2. Those whose origin is not in the vertebræ; as deviations originating in a defect of the equilibrium of muscular power, depraved positions engendered by particular kinds of labour, &c.

The consideration of the first of these two kinds belongs more especially to medical works. It must, however, be observed that many disfigurations of the shape are to be attributed ultimately to phenomena

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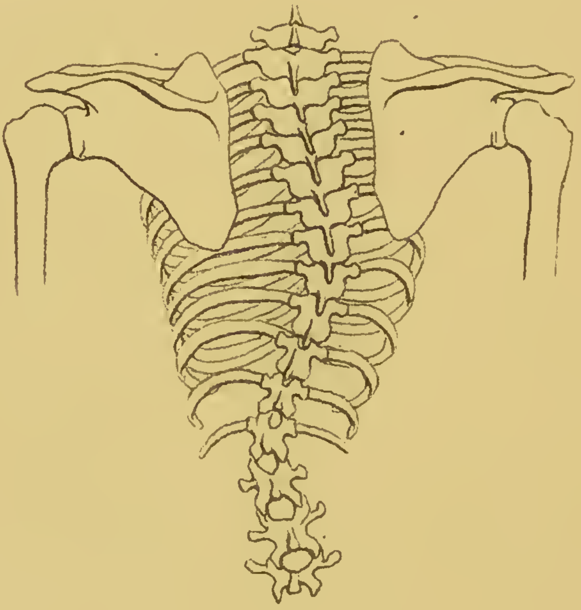

Deformed Skeleton.

purely mechanical, although their first cause may have been of a different kind. In fact we attribute these deformities to a want of equality of power which ought to have existed between the muscles of the back having attachment to various points of the spinal column, and exerting an action on the body.

The spinal column is susceptible of different kinds of curvatures, which in some cases make the spine bend outwards or inwards; in others, make it resemble the letter S; and in others still, give it the form of a zig-zag, or of a part of that figure. It may also be twisted on its axis.

The lateral deviations are more frequent to the right than to the left. They are rarely single, that is, there is rarely but one curvature; they are most frequently composed of three curvatures—one lumbar to the left, one dorsal to the right, one cervical to the left, in order to establish equilibrium, or vice versa,—the centre part of the curvature being always considered in its relation to the line in which the centre of gravity of the body is found.

Thus we designate curvatures according to the place which they occupy on each of the four sides of the line of the centre of gravity of the body. If the displaced vertebræ are to the right of that line, then the curvature is said to be to the right. If before, the curvature is forward; and so of the others. If the curvature is double, or rather if the column exhibits the form of an S, we denominate the deviation according to the direction of the principal or primitive curvature.

CHAPTER II.

SLIGHT AND TEMPORARY DEVIATIONS.

When the shoulders are too much raised, the neck appears shorter and more sunk. They are sometimes both uniformly raised, or one more than the other, and sometimes one only has deviated, while the other maintains its natural position.

Inequality in the height of the shoulders may be the effect of the bad habits which children are made or allowed to contract: such as the use of leading-strings to make them walk; the custom of making them sit in an arm-chair which has the arms too much raised; and that of placing them too early in conical baskets or go-carts without a bottom, which are provided to teach them to walk, or more properly speaking, to get rid of them for a while, and save the trouble of teaching them to walk.

Children incapable of standing alone, sustain themselves entirely on the upper rim of these baskets or go-carts, by means of their armpits; they are rather more hung up by the armpits than supported by the feet, especially when they are left any length of time, as generally happens. This habit may determine the simultaneous elevation of both shoulders; whilst the custom of standing on one leg, or writing or drawing upon a table too much raised, &c., determines only the elevation of one.

When a child contracts the habit of allowing its arms to fall before its breast, the shoulders become projecting behind and rounded, and the shoulder-blades become removed from the spines of the vertebræ, to rest on the convex portion of the ribs which pushes them backward and to the side, so as to make them project more. The clavicles compressed between the sternum and the shoulder, become more curved and diminish in length, at the same time that they project more under the skin; the breadth of the chest diminishes equally; the shoulders are narrowed above, at the same time that the arms are brought before the body; the space which is appropriated to the lungs and the heart becoming contracted, these organs are incompletely developed; and as their functions are indispensable to life, it may be conceived of what importance it is to have the cavity which encloses them as fully developed as possible.

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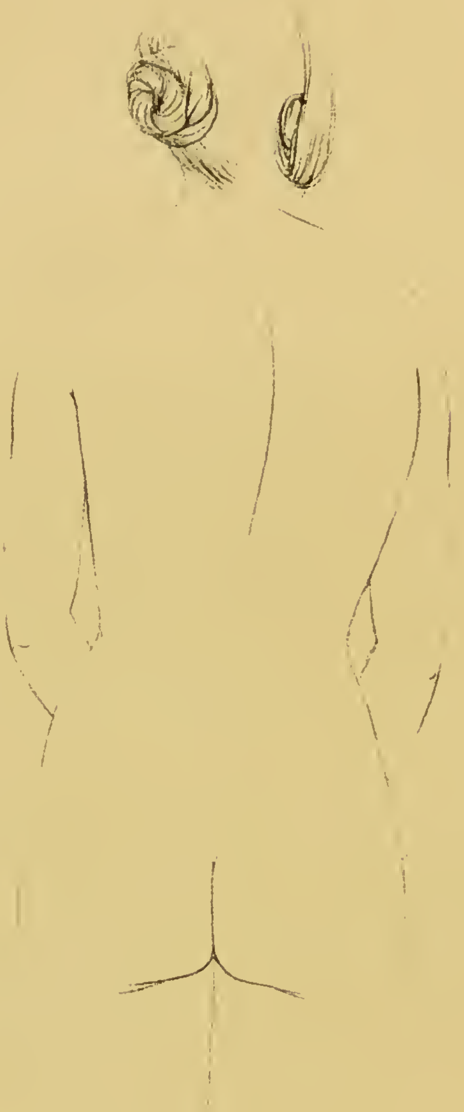

Right Lateral Curvature.

CHAPTER III.

RIGHT LATERAL CURVATURE.—DESCRIPTION.

This curvature, having its convexity to the right and somewhat posterior part of the chest, or in the direction of the space between the spinous and the right transverse processes, commonly begins at the lower cervical and terminates at the lower dorsal vertebræ, its centre corresponding nearly with the plane of the right axilla.—See Figure XII.

It is the most frequent, not only of those which depend upon muscular action, but of all without distinction. It is indeed so common, that, out of twenty young women at the age of fifteen years, there are not two who do not show traces of it.

The two sexes are not equally liable to affections of this kind: whilst in infancy both sexes are affected with them in about the same proportion, girls are in a much greater proportion subject to them, especially about the time of puberty.

When this curvature is the effect only of muscular action, it rarely attains the extent of a quarter of a circle, and the bodies of the vertebræ which are affected by the curvature present only a slight depression on the side corresponding to the concavity.

Whatever may be the first cause of the deviation, we remark at once that the right shoulder presents a greater deviation, and is larger than the left. When examined attentively, this thickness and elevation are found to depend much less on the curvature itself, than on a greater development of all the parts constituting this portion of the body, a circumstance which sufficiently indicates the cause of this deformity, and precludes all doubt as to the choice of the means which would effect a cure.

If we compare the two shoulder-blades and their relations to the spine, we see that the right is raised, whilst the left is depressed; the inferior angle of the right forms a considerable projection behind, whilst the top of the shoulder is carried more forwards; the left hip projects more than the right, the pelvis being inclined in such a manner as to produce an inequality in walking; and one of the sides of the body, advancing more than the other, progression seems to take place obliquely. The right side of the chest is rounded and protruding, whilst the left is flattened and sunk; the right flank and lumbar region are depressed, and the inverse disposition is observed in the left.

The spine itself when examined presents a double curvature, one of which is convex, to the right, in the dorsal region at the height of the shoulder-blades, and the other convex to the left in the lumbar region. The dorsal convexity, by separating the ribs from each other, raises the right shoulder-blade under which they are placed, and by the effect of the twisting of the spine, the convexity of these ribs is carried backward, and their curve augmented, whilst the ribs of the left side, being likewise drawn from their position by this tortion of the spine, are carried forwards, depressed, approximated to each other, and no longer afford a point of support to the shoulder-blade and the shoulder, which become depressed.

When the deviation is more marked, a third curvature is formed in the inferior cervical and first dorsal vertebræ. The first ribs which have their attachment to the right in the concavity of this curvature, are then depressed with the superior angle of the shoulder-blade which they no longer support; whilst the inferior angle is raised by the fifth and sixth ribs. To the left, the contrary is observed; the cervical region is enlarged, whilst the inferior angle of the shoulder-blade is no longer sustained by the ribs which have their attachment in the dorsal concavity.

These displacements are not the only ones which the ribs undergo, independently of lateral curvatures. —The spinal column, as already said, is bent upon itself, so that the spinous processes are carried outwards on the side of the concavity of each curvature: the transverse processes follow this movement, which occasions at the same time to the ribs which are attached to them, important modifications in their form, and in the disposition of the muscles.

In the middle of the dorsal region of the right side, the posterior part of the ribs is drawn backwards by the movement of the transverse processes, and contracts a well-marked curvature in that place, whilst the anterior portion of these same ribs loses the curved form, from their being dragged backwards, which explains the flattening of the chest in front of this side and its posterior roundness. To the left, the ribs are, on the contrary, dragged forwards by the same rotary motion, in such a way that their posterior curve diminishes, whilst the anterior one increases: whence arises the flattening of the chest backwards, and the prominence forwards.

In the lumbar region, this rotation acts on the muscular mass of the Sacro-lumbar and Long muscle of the back, which are raised to the left by the transverse processes of the lumbar vertebræ, and form in this place a hard tumor, and are sometimes much protruded; whilst to the right, where the transverse processes are carried forward, they no longer support those muscles, which sink down.

All the muscles of the trunk must necessarily feel the effects of such a change in the structure of the bony frame-work to which they are attached. Those whose insertion is at a distance, must naturally be distended and elongated, the exercise of their contractility is broken, and the fixed position in which they are obliged to remain, contributes greatly to their weakness, which sometimes even reaches paralysis. The muscles whose attachments are near, are, on the contrary, reduced to a state of relaxation which tends to shorten and contract them. Sometimes, this shortening is even such, that it renders the deformity incurable, or at least very difficult to cure.

Lateral deformities rarely take place without involving more or less seriously the internal organs. It is not necessary that these deviations should be very extensive, to be very hurtful, and perhaps the disproportion sometimes then observed between the cause and effect, arises from predisposition hitherto unknown; but even in these cases, the deformities of the spine become an occasional cause, without which lesions of the heart or lungs might not have taken place.

When the deviation affects only the dorsal part, there is a slight constraint in respiration, and less ease, and especially less elegance, in the motions of the limbs. But if this deviation is considerable, if it affects both the cervical and lumbar portions, then the results become alarming: the longitudinal diameter of the trunk is diminished; the cavity of the chest is narrowed by the twisting of the ribs and their deformity and difficulty of motion; the diaphragm pressed upon the abdominal viscera is not able to contract itself and thereby give a larger space to the chest; hence an habitual constraint in respiration and circulation, cough and palpitation of the heart, and the feeling of oppression and suffocation which patients experience when they wish to accelerate their walk and perform different motions.

The organs contained in the abdomen are compressed by the sinking down of the diaphragm, and by the projection of the transverse lumbar processes which causes them to be carried forwards, and to distend the abdominal parietes, the muscles of which are relaxed by the approximation of their points of attachment, a disposition which produces that projection of the abdomen common among hump-backed persons.

This compression of the abdominal organs explains very well the different affections of the stomach, liver, and kidneys, to which deformed persons are subject. On the other hand, the approximation of the brain to the centre of circulation causes that organ to be more strongly acted on, whence arise head-aches, and perhaps the cerebral excitement, which is said to be one cause of the ready wit and vivacity generally found among hump-backed persons.

We are not yet sufficiently aware of the precise influence of deformities on the spinal marrow.

CHAPTER IV.

CAUSES, AS DEPENDENT ON THE VERTEBRÆ.

The extreme frequency of this curvature has even made many anatomists believe that it is the effect of some natural disposition, and they have attributed it to the presence of the arch of the aorta, which beats against the left side of the anterior part of the bodies of most of those vertebræ, which, by deviating from their natural direction, commonly constitute it; but many examples of its existence in subjects, all of whose thoracic organs, and consequently the arch of the aorta, were transposed, have shewn how slight is the foundation for that opinion. This reason, indeed, is quite as good as if we were to say that the aorta is arched by the pressure which the spinal column extends over it: the one will be as reasonable and as likely as the other.

The body of the cervical vertebræ of man presents, at its upper surface, an eminence which receives the inferior part of the body of the vertebra which is placed above it, and limits its lateral movements.

From this, it results that the cervical region of the vertebral column can be curved little either to the right or to the left.

In the lumbar region, things are nearly the same as in the cervical, except that the surfaces of the bodies of the vertebræ are larger and smoother, which is less favourable to deviations of every kind, and the ligaments are of remarkable thickness and density. Moreover, the intervertebral fibro-cartilages are here very thick; and the articular processes, instead of presenting inclined surfaces, are turned directly inwards and outwards, which renders them favourable to rotatory motions, but does not confine, in any way, those of inclination.

In the dorsal region, Nature appears to have been more careful of the solidity of the articulations of the vertebræ, or rather she appears less dependent on muscles, probably from the importance of the organs of respiration, and from their functions requiring dimensions better secured. Here, the bodies of the vertebræ are small, but smooth; they are elongated from behind forwards, the direction in which their inclination would be most easy and dangerous; the articulating processes are prolonged obliquely, and their surfaces are inclined; sufficiently strong ligamentous masses unite their processes together; the anterior and posterior fibrous layers of the bodies of the vertebræ are thicker; the intervertebral fibro-cartilages are thinner, except towards the lower part, and consequently are of greater density. Lastly, two ribs fixed on each side, to the two superior vertebræ by their head, to the inferior by their tuberosity, bind more firmly than all the rest, the two corresponding vertebræ, by making them constitute part of a regular system, no portion of which can separate itself without a great alteration in all the modes of union. Notwithstanding, this very solid junction may be relaxed.

The preceding reflections are necessary to show, that the preservation of the form of the spine, in its normal state, depends very much upon the method of articulation and on the muscles, the slightest change in the normal state of the diarthrodial cartilages, in that of the inter-articular fibro-cartilages, in that of the synovial membranes which cover the moving surfaces, in that of the muscles surrounding—the slightest alteration in all the organs of this description, or in some only, and sometimes even in one, may produce very extensive and very important consequences.

CHAPTER V.

CAUSES DEPENDENT ON PRESSURE.

Clothing has hitherto had much influence in producing these disastrous results. In vain many enlightened men have besought women to adopt only such modes of dress as would injure neither health nor beauty; their voice has hitherto been, and perhaps will still long be, powerless against the influence of fashion and prejudice.

The part of female attire against which objections have been raised with most justice, is that circular instrument of constriction applied to the chest and known under the name of stays; a barbarous instrument, invented, by the most depraved coquetry, to give to the figure a supposed lightness which it ought not to have, or to conceal some deformities which it often only increases!

Rousseau opposed the corruption of taste which declared that the figure is excellent in proportion as the waist is narrow, with all the power of his genius, and all the warm interest which he took in youth;

but his arguments, however natural and attractive, long failed, and we were reduced to form wishes only that women should subject themselves to this voluntary punishment at as late a period as possible, that is, only at a period when their body had approached the limit of its full development, and to desire that those who had paid to nature the debt of maternity, should see that the reasons which render stays desirable in their own eyes, do not exist in reference to their daughters, while yet in infancy.—Happily, the introduction of elastics by a London stay-maker, Mrs. Mills, and an improved formation of stays, especially the banishment of upright pieces, deprecated by Soemmerring, has, in some degree, remedied this.—Still the great evil escapes remedy: *all stay-makers leave the stays sufficiently narrow to admit of being drawn far too tight either for health or beauty.* PARENTS SHOULD SEE TO THIS: THE STAY-MAKERS WILL NOT, FOR FEAR OF OFFENDING THEIR YOUNG CUSTOMERS.

Let the stays of young girls then be freed as much as possible from the stiff pieces of whalebone, and the steel-plates which give them the appearance of a case of instruments, and let them be formed chiefly of a firm, but elastic, tissue, which by giving a slight support to pendent parts, may yield to all motions without injuring the free development of the breast, and without destroying the muscles which have the office of giving to the vertebral column that degree of resistance which, in well developed bodies, permits that osseous pillar to sustain properly the parts which it is designed to support, and to furnish a solid point of connection for the contractible tissues which are attached to it. A natural dilatation of the chest, and a proper development of the muscles which cover that osseous frame-work, will not indeed contribute to give the figure that slim appearance, or rather that shrunk up form which some young girls so eagerly desire; but regularity of form and beauty will be better determined, and it will be sufficient for the most ambitious woman to shine by natural attractions, without aspiring to a finer figure than either nature or ancient art presents to us.

And what is the influence of such stays on beauty? When stiff whalebone and extreme tightness are employed, it would seem that a wasp, or one of those glittering insects that flutter over the surface of ponds, is no inapt resemblance of a woman dressed up in this ridiculous apparatus. What can be more absurd than to see a being whose body appears united by a very small tube to the hips, and the hips themselves rendered of an enormous size by excessive padding?

Generally speaking, tight stays destroy also the firmness of the breast, sometimes prevent the full development of the nipples, and give rise to those indurations of the mammary glands, the cause of which is frequently not well understood, but which are followed by such dreadful consequences. Their effects, however, go still deeper; though they cannot affect more vital parts.

Portal states, that the muscles of the back are larger and stronger in women who have not worn stays than in others; that it is scarcely possible to demonstrate these muscles in those who have worn stays; and that they have been so weakened by pressure and want of use, that (when the stays were removed) they were incapable of supporting the body.*

Van Swieten says, that "those wretched women who have been long accustomed to wear those coats of mail (loricæ) can never lay them aside, lest the chest should fall forwards, in consequence of the weakness of the dorsal muscles, which when in health, and properly exercised, are capable of supporting the spinal column erect and firm, even under heavy burdens. I could not view but with pity those miserable women who not even during sleep dared to take off their stays, who frequently could not turn themselves in bed, much less raise themselves up when in bed, or maintain the body in an erect position."*

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* "Il est trés important d'observer que les personnes qui n'ont fait aucun usage des corps ont les muscles du dos plus forts et plus volumineux que les autres. On peut même dire qu'on a peine à démontrer les muscles du dos dans les femmes qui se sont distinguées à porter des corps étroits. . . . Les muscles du dos, a force d'avoir été comprimés et d'être restés dans l'inaction sont devenus incapables de maintener le tronc en equilibre."

That men would suffer in the same manner if similarly laced up, and consequently that stays and tight lacing are a main cause of deformity, is shown by Soemmerring.

From the year 1760, till about 1770, Soemmerring says it was the fashion in Berlin and other parts of Germany, as in Holland a few years before, to put stays also on boys. This, however, fell into disuse, as at Leipzig and other places, they began to observe that unlaced children grew up straight, but those who, out of regard, were treated with this particular care, got by it a high shoulder or a hump.

Families in which there were several boys, the handsomest only of whom were laced, discovered this, from these alone becoming hump-backed. They sought the fault in the stays being wrongly put on; till at length, in England, it was first plainly seen that no boy with stays grew up straight, not to mention consumption, rupture, &c., which they thus predisposed them to.

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* "Unde miseræ mulieres, quæ a prima juventute his loricis usæ fuerunt, illas postea deponere nequeunt, quin antrorsum collabatur totus truncus corporis, musculis dorsi inertibus redditis, qui, in valido et exercitato corpore, spinam dorsi erectam et firmam tenere possunt, licet grave pondus humeris imponatur, uti in bajulis videmus. Vidi non sine commiseratione miseras tales feminas, quæ ne quidem somni tempore deponere audebant loricas expertas, jam sæpius quod vix se vertere in lecto possunt, multo minus corpus in lecto erigere vel erectum sustinere."

The influence of stays during pregnancy is still more disastrous. If they do not produce abortion—if as Soemmerring observes, the case proceeds somewhat more favourably, so that the infant, with the other parts, attains the full size in spite of continual, though certainly diminished, opposition, still the upper part of the thorax in the mother is so changed that, after the first or second lying-in, the high shoulder invariably presents itself. While this is going on, the mother suffers much without the least necessity from head-ache, giddiness, difficult respiration or narrow chestedness, nausea, vomiting, gripes, inclination to faint, varicose veins, swelling of the bones, diuresis, tenesmus, prolapsus of the rectum, constipation, cough, as well as herniæ and various nervous sensations.

All this may be very easily explained according to the best known laws of the animal economy.

Head-ache and giddiness the mother must suffer, because the stays and some internal parts press at the same time on the cavities of the thorax and the abdomen, and determine the blood toward the head, the only cavity free from pressure.

Breathing the mother feels difficult, since not only the stays, but also the growing parts, narrow the cavity of the thorax, and prevent the expansion of the lungs.

Nausea and vomiting torment the mother, because the stomach is compressed by the stays and these parts, and seeks to empty itself.

Pains of the bowels, colics, arise because sometimes one and sometimes another portion of the intestine is pressed and pained by the stays, &c., or because the fæces cannot pass, but generate air, and painfully distend the gut.

The mother is subject to fainting, because the blood still runs freely enough through the branches of the descending aorta, but, from the pressure of the stays, &c., is impeded in its return by the veins, and consequently the vessels of the brain receive too little blood.

From similar causes, swelling of the veins of the feet arise in many cases, which, without the pressure of stays, would not have occurred.

The pressure on the absorbing vessels of the feet, causes the fluid absorbed to move more slowly in them, and the feet thereby swell.

Diuresis the mother must endure, because the urinary bladder, on account of opposition from the stays, &c., cannot properly expand, cannot contain enough of urine, and is forced soon to empty the little it has received.

Tenesmus tortures the mother from the same cause.

Likewise from the same cause, the intestines are pressed out in rupture, or the rectum is prolapsed.

Similarly arises loss of sensation and motion of the feet from pressure on the nerves, which supply the lower extremities.

The many nervous sensations we shall not attempt to explain.

I have often, says Soemmerring, seen many of these evils in laced pregnant women disappear or diminish, particularly nausea, fainting, giddiness, and difficulty of respiration, the moment the stays were taken off!

As to the infant, malformations, club feet, or twisted feet, are often occasioned like the generality of defects, by the tight lacing to which the mother has recourse, in order to conceal her pregnancy.

I do not believe, he adds, that in an otherwise sound mother the form of the child suffers, except in so far as the stays, or the alteration in the body produced by them, opposes its general growth, and as seen above, causes premature delivery. We daily see, that strong, healthy, well made, and in short perfect children, are born of the weakest, and from the stays most injured, but otherwise sound mothers. —In his work entitled INTERMARRIAGE, Mr. A. Walker has shown this to be erroneous.

Pecklin, B. Scharf, and Winslow, were of the same opinion, that the use of tight stays cripples or kills children; Ludwig has seen impressions of these stays on the foreheads of children; Siebold described a very large hernia cerebri, possibly owing to defective formation caused by the use of such stays by the mother.

As intimately connected with the subject, we must here speak of

Diseases produced by compression from stays.

"One is astonished," says Soemmerring, "at the number of diseases which stays occasion. Those I have subjoined, rest on the authority of the most eminent physicians.—Tight lacing produces,—

"In the head: headache, giddiness, pain in the eyes, pain and ringing in the ears, and bleeding at the nose.

"In the thorax: besides the displacement of the bones and the injury done to the breast, tight lacing produces shortness of breath, spitting of blood, consumption, derangement of the circulation, palpitation of the heart, and water in the chest.

"In the abdomen: loss of appetite, squeamishness, eructations, vomiting of blood, depraved digestion, flatulence, diarrhœa, colic pains, induration of the liver, dropsy and rupture. It is also followed, by melancholy, hysteria, and many diseases peculiar to the female constitution, which it is not necessary to enumerate in detail.*

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* DISEASES ASCRIBED TO THE USE OF CORSETS.

The number of diseases which are produced by stays, according to the testimony of medical men, is astonishing. I give but one guarantee for each. They cause—

"Another effect of tight corsets," he observes, "is that those who have been long so closely laced, become at last unable to hold themselves erect, or move

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In the Head,	
Headache, according to	Bonnaud.
Giddiness	Müller.
Sleepiness	Bonnaud.
Apoplexy	Müller.
Tendency to fainting	Grunes.
Pains in the eyes	Müller.
Ear-ache	Müller.
Bleeding at the nose	Bonnaud.
Stoppage in the nose	Müller.
Flow in the mouth and lips.	Bonnaud
Obliquity of vision	Camper.
Stopping with slime in the throat	Winslow.
Carotid aneurisms	Morgagni.
In the Chest.	
Displacement of the bones of the chest from their situation	Platner.
Depression of the lower bone of the sternum	Müller.
A false support given to the thorax, and the development of the real support impeded	Brinckman.
Hunchback	Winslow.
Inability to suckle in consequence of pressure on the breasts	Bollexserd.
Scirrhus in the mammary glands, and ultimately cancer, according to	Oelsner. and all others, without any exception, who have written on the injurious effects of lacing.
Pain in the region of the heart	Winslow.
Sores on the chest	Bonnaud.
Impediment to the action of the lungs	Platner.
Adhesion of the lungs to the diaphragm	Kositzki.

with comfort without them; but, as is very correctly said, fall together, in consequence of the natural form and position of the ribs being altered. The

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Asthma, according to	Gaubius.
Short breath (dyspnœa)	Josephi.
Hooping cough	Bonnaud.
Cough	Bollexserd.
Spitting of blood	Huxham.
Abscesses in the lungs	Bonnaud.
Cavities in the lungs	Reinhard.
Consumption	Swieten.
Impediments in the action of the heart	Platner.
Disturbance of the circulation and hence inflammation, &c.	Gaubius.
Polypus	Bonnaud.
Water in the chest	Bonnaud.

In the Abdomen.

Disturbance of the functions of the diaphragm	Wormes.
Pressure on the stomach	Bollexserd.
Hence pains in the stomach	Wormes.
Loss of appetite	Müller.
Sickness	Schnizlein.
Acidity	Bonnaud.
Vomiting	Winslow.
Vomiting of blood	Wormes.
Bad digestion	Winslow.
Scirrhus of the stomach	Bacher.
Flatulency	Müller.
Diarrhœa	Bonnaud.
Adhesion of the intestines	Rougemont.
Induration of the mesenteric glands	Winslow.
Colic pains	Bonnaud.
Tenesmus	Bonnaud.
Hæmorrhoids	Bonnaud.

muscles of the back are weakened and crippled, and cannot maintain themselves in their natural position for any length of time. The spine, too, no longer

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Fistula in ano, according to	Bonnaud.
Dysentery	Bonnaud.
Hypochondriasis	Rougemont.
Compression and obstruction of the liver	Mascagni.
Jaundice	Winslow.
Inflammation of the liver	Wormes.
Hardening and suppuration of the pancreas	Bonnaud.
Diseases of the spleen, inflammation, suppuration, and scirrhus	Bollexserd.
Disease of the kidney	Camper.
Calculi	Wormes.
Strangury	Bonnaud.
Hernia of the bladder	Bonnaud.
Bloody urine	Gaubius.

Hysteria	Bonnaud.
Disturbance of the catamenia	Platner.
Leucorrhœa	Müller.
Hardening of the ovaries	Targioni.
Inclination of the mouth of the uterus towards the sacrum	Mohrenheim.
Scirrhus of the womb	Wormes.
Hæmorrhage from the uterus on the separation of the placenta	Bonnaud.
Sterility	Josephi.
Unhealthy children	Platner.
Ugly children	Josephi.
Monstrosities	Diehold.
Miscarriages	Camper.
Premature labour	Müller.
Difficult labour	Unzer.

accustomed to bear the destined weight of the body, bends and sinks kown.

To recur to the subject of pressure and the deviations arising from it,—in most cases of considerable deviation, the curvatures are chiefly produced by the derangement of the muscles and of the intervertebral ligaments, the latter being elastic but capable of acquiring more or less of density, and disposed, by the properties which belong to them, to shrink on the side where they are more pressed by the deviation of the spine, to such a degree that, on that side,

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Protracted labour, according to	Hannes.
Adhesion of all viscera of the abdomen to one another,	Nepli.
Disfiguration of the viscera	Müller.
Dropsy of the belly	Morgagni.
Herniæ	Richter.
Swelling of the upper extremities	Bonnaud.
Swollen feet	Wormes.
General Disease.	
Pains	Gaubius.
Want of energy	Bollexserd.
Melancholy	Ludwig.
Flying heats	Bonnaud.
Intermitting fever	Reinhard.
Eruptions	Reinhard.
Chlorosis	Winslow.
Atrophy	Baches.
Epilepsy	Müller.
Tendency to disease of the bones	Wegelin.
Sickly and short life	Camper.

being reduced to the thickness of a sheet of paper, or quite destroyed, they may be compared to the point of a wedge, whereas on the other side they resemble its broadest part.

It is when the approach of puberty gives a relatively greater increase to the chest and the pelvis, that these deviations frequently commence, or at least are perceived for the first time. All the organs then appear saturated with liquids and more soft. May not the vertebræ also, like the other parts of the body, lose a little of their solidity, and oppose less resistance to the pressure exercised on them by weight and the powers which tend to bend them? Hence, young girls who previously had but a very slight deviation of the spine, become, at that epoch, and in a little time, often extremely mis-shapen: the vital forces also, concentrated on an internal organ, which receives a new development in order to fulfil the uses for which it is destined, leave the other parts of the body in a state of languor, which favours the influence of weight and of a bad attitude.

It is a fact of very great importance that our organs in general contract forms and volumes which are in a ratio compounded of their power of development, and of the different pressures to which they submitted, so that these pressures become an important element in their future configuration.

It is, therefore, easy to conceive that the intervertebral substances compressed towards the concavity of the curvature, and distended towards its convexity, will by degrees acquire a greater thickness on one side than on the other, and thus render permanent the curvatures which at first were only momentary. But it is observed that even the bodies of the vertebræ often present a remarkable difference of thickness, when the concave is compared with the convex side, in curvatures of long standing; and this is the place to explain the successive mode of ossification or bony formation of the bodies of the vertebræ.

The ossification of these spongy bones is one of the last which is completed in the animal economy; and, up to the age of thirty, the vertebræ, separated by maceration, almost always present an uneven surface, similar to that which results from the separation of epiphyses. In fact, the researches of physiologists show, that up to eighteen years of age, the upper and lower surfaces of the bodies of the vertebræ remain separated from the fibro-cartilages by a cartilage of ossification; that, at the age of eighteen, a laminar epiphysis or osseous layer begins to be formed, which is immediately in contact with the surface of the fibro-cartilage, but which still remains separated from the body of the bone by a layer of cartilage of ossification; and that the conversion of a cartilage of ossification into an osseous substance, is always preceded and accompanied by a kind of sanguineous injection or fluxion.

In applying these principles to the changes of form of which the bodies of the vertebræ may be susceptible, it will be conceived that an habitual compression on one of the sides of the cartilage of ossification must diminish on that side the future osseous development, so much the more effectually as it not only tends to diminish the volume of the still flexible organ, but as it at the same time opposes the sanguineous fluxion, which appears to be the necessary condition of all ossification.

CHAPTER VI.

CAUSES DEPENDENT ON HABITS.

No truth can be better established, than the effect of peculiar attitudes on the form of persons engaged in various occupations. Tailors, shoe-makers, clerks, &c. have their persons more or less affected by the attitudes peculiar to their business.

We may point out, as among the attitudes which contribute to the curvature of the spine, the manner of holding the body in writing and drawing, when the tables are too high or too low, and when lessons are protracted for too long a time; the position which must be assumed in order to play certain instruments of music, &c. &c.

If these pernicious positions are often repeated, if the patient be weak, lymphatic, at the period of increase, easily fatigued, the spine at length takes a wrong direction, and the constant pressure exercised on the same parts, ends in deformation, whilst the unfavourable direction in which the muscles act, weakens some and determines in others stronger contractions, which draw the spine more and more in unnatural directions, and increase the deviations.

It is nevertheless true, that the most regular position of the body is always the most convenient and methodical for drawing and writing—it is the posture which good teachers recommend most; so that bad attitudes are not necessarily attached to these occupations.

To play the piano, the body must be central in relation to the instrument; the height of the seat must be such that the keys may be precisely within reach of the hands. The fingering is always much varied, and, far from inducing a uniform and vicious attitude, brings into operation a great variety of motions and requires a very regular position of the body.

In like manner, the study of the harp does not require a vicious or dangerous position. The body ought to be kept perpendicular, to give firmness and lightness to all the motions of the arms; the simultaneous touching of the most distant chords is rare, and does not require a forced attitude, but it ought to be formed by the extension of the left arm and flexion of the right, and not by moving the shoulders and curvatures of the spine: it would be to make gratuitous difficulties to place the performers in an uncomfortable position which could not be kept; and the poising of the instrument is not an affair of the arms, which ought always to remain free in order to reach the chords.

Curvature of the body forwards, is the only result of position common to these two pursuits; but the kind of elongated arch, which is sometimes observed in advanced age, is not the kind of deformity commonly to be feared in youth, and the causes of which are looked for in the occupations in question.

It must not, however, be inferred, from what has just been said, that the exercises of which we have spoken, are in no case dangerous. They are not always practised so correctly as is requisite. Some even, such as writing, drawing, embroidery at the tambour or frame, force some inclination of the trunk; and if persons so engaged, have already experienced a slight degree of deformity, or simply a single alteration of the ligaments which determine it, these exercises may add to the power of the causes. When the deviation is once begun, the patient places herself so as to be able to vary conveniently the motions of her arms and hands, and the attitude which she chooses is always favourable to the development of the deformity.

In many of these causes, and in others which we omit, the inequality of the muscular power of the spine is rarely primitive, but appears to be almost always owing to a continued position of that part in the same vicious direction, which, by elongating certain muscles, weakens them, whilst others, being relaxed, contract and afterwards oppose great resistance when we would straighten the spine, if this position has lasted long; and thus that which was at first only the transient effect of a wrong position, insensibly becomes a permanent alteration of the bony, ligamentous and muscular parts.

Some authors have pretended that the first curvature is always formed in the lumbar region, and have supported their assertion by reasonings which do not appear conclusive. In truth, the lumbar region, far from being more moveable laterally than the dorsal region, is less so, owing to its transverse processes being largely developed, and to the transverse breadth of the body of its vertebræ, whilst the dorsal vertebræ have their greatest diameter from before backwards, which must facilitate lateral curvatures in that region: often indeed the two curvatures are formed at the same time, or so nearly at the same time, that frequently it cannot be ascertained which was first.

From the necessity however of changing position to rest the muscles, it occurs, that, when we are standing, we alternately balance ourselves first on one leg and then on the other, but most frequently on the left. So also a child whose spine is deformed, in standing upright for some time, generally does not keep its feet in the same line, but one is placed before the other.—Curvature, however temporary, is the result.

We may readily conceive, from this, what a pernicious influence must be exercised on the spine, by the erect position which young persons are obliged to keep when they are motionless, upon a stool, and deprived of all support for the spinal column.

Every practitioner remembers cases analogous to the following:—A mother, alarmed at the shape of her daughter, consults a man of note, but little skilled in cases of this nature. One hip appears to project laterally more than the other; and it is observed that the young person so affected has a habit, when standing, of resting the weight of her body generally on the leg corresponding to the projecting hip, and of slightly flexing the opposite limb, and at the same time throwing it a little forwards,—for it may begin thus, though not so usually as at the shoulder. The slight alteration of the figure is attributed to that bad habit which the young person cannot be induced to abandon. After the lapse of some time, the shoulders lose their level: the one opposite to the projecting hip becomes higher than the other, and the spine becomes deformed laterally at this part. This deformity increases rapidly; and, in some months, the young person loses some inches in height. Then the hip just mentioned as out of place, becomes much more projecting, and it is proved that, owing to the habit of standing, there existed first, a lateral curvature in the lumbar region; that the projection of the hip bone coincided with the convexity of that curvature, and was the consequence of it; and that the opposite direction of the curvature in the dorsal region was the consequence of that in the loins.

We may, then, add as causes, the different paralyses and inequality in the length of the inferior extremities; whether this inequality arises from a defect of increase, or whether it depends upon a previous malady, such as dislocation of the hip, curvature in the bones of the extremities, bow-legs, distortions of the feet, &c. The body then, not finding on that limb an equal uniform support, contracts the habit of inclining to that side.

Thus, whenever one inferior extremity is shorter than another, from whatever cause this accident may arise, a curvature of the lumbar region is first occasioned; this then determines another in the dorsal region; and generally a third is not long in appearing in the cervical region. These three curvatures are evidently consecutive; they are readily made to disappear by suitable treatment; but they will re-appear promptly, unless by some means or other we establish equality between the two inferior extremities.

CHAPTER VIII.

CAUSES DEPENDENT ON MUSCLES.

Nothing is more variable than the dynamic state of the muscular system; the slightest accidents exercise greater or lesser influence over it. Now these may coincide, and do, in fact, often coincide with the premature development of the skeleton, and may produce so much the more surely their ordinary effects. The eruptive diseases common to infancy, an irregular regimen, bad and insufficient food, total neglect of physical education, dwellings damp, badly ventilated and lighted, and unhealthy in every other respect, intellectual education ill devised, and ill directed, or even one of these conditions existing in a slight degree, but supervening, at the time designed by nature for the development of the skeleton, may render the ordinary consequence of that increase very hurtful to other organs.

There are few children of either sex, of ten or twelve years of age, who are not bent forwards; especially if they grow quickly; because the muscles are weak, and their contraction incomplete, and the curvatures of the spine being increased the ligaments have to support the weight of the parts above. Those who, when young, have suffered under illness, long enough to form, or carry to a great degree, the muscular weakness which causes the curvature forwards in the dorsal and cervical region, as means of relieving the muscles, often preserve all their lives that stoop, because the ligaments of the spine, being incapable of supporting alone the weight of the parts above, have given way, and permitted great inclination to the vertebræ.

These increased and temporary curvatures of the body, dependent on the temporary weakness of the muscles, are at first always from before backwards, and from behind forwards. But, in order that these deviations should continue in the same state, it would be necessary that all the ligaments should have the same consistence, which rarely happens. If elongation take place more in one side than the other, in any point, there must be compound deviation; for as the equilibrium is threatened, it will soon make an effort in an opposite direction, which will speedily produce a corresponding elongation.

These things are common; they have been often observed and noted; and a fact in support of them, which has not escaped observation, is, that such merely are the cases in which some exercises, a succulent diet, cold baths, and tonics, are sufficient to restore the natural form;—not that it is probable that any thing can have restored the distended ligaments to their proper size, but that the muscles have recovered their powers, re-established the natural direction of the bones, arrested the distension of the ligaments; and the bones have acquired new growth, during which the error of their mode of union is obliterated.

Bichat says, "I rather think that as every effort is made with the right arm, and that as, in these efforts, we are obliged to lean a little in an opposite direction, in order to afford a solid point of support for the limb, the habit of frequently repeating this inclination ends by perpetuating its existence."

Every time any part of the body has to execute a motion, the first condition of the motion is to fix the points to which the muscles which have to move it are attached. Thus the pelvis must be fixed for the motions of the thigh, and the thigh for the motions of the leg. Thus, especially in the motions of the thoracic extremity, the shoulder must be fixed in relation to the trunk, and the trunk itself in a determined and firm position, in order that the motions may have their effect.

We further observe that, during an action of moderate energy, regard being had to the power of the person exercising it, the muscles most immediately engaged in furnishing fixed points to those which produce the motion, contract alone, whilst in a very energetic action or with a very weak person, a great number of muscles contract as auxiliaries to increase the stability of the points on which the motion is to operate.

The shoulder-blade, which is to present to the motions of the arm the fixed points which are requisite for them, either in the attachment of the triceps, the biceps, coraco-brachialis, &c., or in resistance to the displacement of the head of the humerus, the shoulder-blade, I say, can be rendered immoveable only by the simultaneous contraction of the trapezoid, rhomboid, &c.

All these muscles which fix it, take with the exception of the great serrated, their principal attachments from the spinal column or the head. The trapezoid is in this point of view one of the most important. But it becomes evident that the shoulder-blade itself cannot be fixed in an immoveable manner, unless the superior part of the vertebral column, and the head present in their turn a fixed point for the trapezoid, angular, rhomboid, &c. Now the superior part of the spinal column being, from its structure, essentially moveable and flexible, it is indispensable that the majority of the muscles of the neck and the body should contract simultaneously, in order to support the head, the neck, and the upper part of the dorsal region of the spine in a suitable state of rigidity.

In an individual well made, and in the enjoyment of all her muscular vigour, the habitual efforts of the superior extremities may be carried on in the manner just spoken of; but in one whose muscular powers are extremely reduced, if the muscles of the neck, being numerous and powerful, are still sufficient to fix the head on the neck, the muscles of the vertebral hollows, aided even by the intercostal, may not be sufficient to give a proper stability to the upper part of the dorsal region, and nature, fruitful in resources, gives to this delicate being means of another kind, which supply perfectly the want of the moment.

The spinal column, when upright, is an elastic and flexible body which the least effort may put into any direction whatever. In this state, it cannot present a fixed point, except by the antagonist action of the muscles which surround it, and whose direction for the most part is nearly parallel to it. But if a straight elastic pillar can be made to bend by the slightest effort, this same elastic pillar, being already curved by a given power, offers at once a rigidity which is proportioned to the extent of the curvature, and which is the result of an opposition between the elastic power, which tends to straighten it, and the power which curves it.

In applying this principle to the cases we treat of, we can see that, if the erect spinal column is eminently flexible and easily mobile, it will become rigid and resisting if any power happens to curve it to a certain point.

In the case of movements of the right arm in a weak individual, such as we have supposed, the curvature of the vertebral column to the left will be readily produced, not only by the muscles which directly move it, but still more by the intercostals, the square muscle of the loins, the broad muscle of the back, the inferior portion of the great pectoral, and even a part of the abdominal muscles. This column being once thus curved, all its upper portion will afford a firm point of support to the muscles, which in their turn must fix the shoulder-blade for the motions of the arm. The left shoulder will be much lowered; the arm of this side will even be pressed against the body; and the right shoulder, slightly raised, will be maintained in that state as long as is required for the efforts to be made with the right arm.

The most common observation bears out this physiological theory of the points of support which the right limb derives from the opposite curvature of the spinal column. The fencing master on guard, has his spinal column forcibly bent to the left side; the child who attempts to open a door with the right hand, is bent to almost a semi-circle; and the player of tennis, ready to seize the ball which passes with rapidity, waits in that position to secure the precise motion requisite to meet it.

We must further remark, that the precision and exactness of certain delicate movements require as much the upper portion of the spinal column to be fixed, as certain abrupt and powerful motions.

A young person embroidering at a frame, drawing or writing, is obliged to guard against the vaccillation of the spinal column, which would produce that of the arm and hand; and consequently, without bending the whole of the vertebral column, as in cases of energetic action, preserves it curved in its upper part however slightly, a circumstance which soon brings on the inverse curvature of the lumbar region.

We now see that the bending of the spinal column in the superior part of the dorsal region, which is necessarily accompanied by a difference in the height of the shoulders, instead of being an effect of a vicious habit, is no more than an indispensable condition for the execution of certain actions of the right arm, so that if one ask a weak and delicate person to perform these motions, keeping herself quite straight, he requires of her a thing physically impossible; which explains a circumstance so well known, and so frequently met with by practitioners, that it is often quite impossible, in spite of the most frequently repeated care and remonstrances, to obtain from the most docile and submissive young person, that erectness so desired by mothers. We hear daily the most bitter complaints on this subject, and there are no young and delicate girls who have not frequently been accused of obstinacy or of negligence in this respect.

We may perceive that it is not absolutely indispensable that the curvature of the spinal column should take place on the opposite side to the active limb, in order that the stability of which we have spoken may be secured in the exercise of certain precise and minute movements of the upper extremities. This fixedness would also be produced, although with less advantage, by a flexion of the side of the acting limb; and this may be actually observed when the hand acts upon a point placed on a level with the height of the pelvis.

There are, however, two reasons why curvatures to the left should be less common: the first is that the opposite curvature offers more advantage to the action of the right limb; the second, that the dorsal region of the vertebral column presents early, in all persons, a slight lateral concavity on the left side. It has been seen that this natural or rather general curvature is to be attributed to the same causes as accidental curvatures, and not, as has been asserted, to the presence of the aorta.

To sum up these considerations, we conclude that a certain degree of flexion in the upper part of the dorsal region of the spinal column, and more frequently to the right, is, with weak patients, an indispensable condition to the stability necessary for the violent motions of the superior extremities, as well as for all motions of the hand requiring exactness and precision, and that the state of curvature, independent of the will of individuals in that situation, must be preserved absolutely during the continuance of these kinds of action.

These views show how erroneous are the notions which are commonly entertained on this subject, and which have led even Dr. Marshall Hall to say, "The inclination is also always to one side, from the comparative weakness of the muscles on the left of the mesial plane; it is cured by calling these particular muscles into action in the system of general exercise."—It is, on the contrary, the fact, that the muscles corresponding to the immediate side of the concavity of a curvature of the spine, are thicker and stronger than those of the opposite side; for if we examine the muscles of the left side of the spine in a patient having right lateral curvature, we find that they are increased in thickness, and that they are at the same time contracted, while the projection formed by the muscles of the convex side is a deception, those of the right side being elongated, their fibres attenuated and discoloured, and tending to a degeneration purely cellular, a very ordinary transformation of soft organs, which, for a shorter or longer time, have ceased to perform their functions.

It appears from a description of deformities, exhibited, on dissection, by the vertebral column of a subject which had been used in anatomical lectures in the amphitheatre of the faculty at Paris by Professor Cruveilhier, that the muscles of the vertebral cavities were a little infiltrated, but otherwise equally voluminous; only they were shrunk and paler in that part of their extent which corresponded with the convexities of the curvatures.

Now, it must further be observed, that when a person remains sitting for some time on a seat without a back, the muscles which occupy the vertebral hollows (and which, aided by the accessory action of those of the back and lateral region of the trunk, sustain the body erect) are easily fatigued, and accordingly the spinal column soon becomes curved. The mutual relation of the articulating surfaces is then such, that they support each other only at the anterior part of their bodies; the resistance which the column makes to the forces which are exerted upon it laterally at right angles, is necessarily diminished one-half; and accordingly the action of the muscles of the right shoulder, however little required it may be to furnish to the arm of that side the support which it requires to play on an instrument, is sufficient however to draw the dorsal vertebræ to the right.

It must then be evident to all who do not decide upon the cause of any abnormal state without taking into account the physiological phenomena which attend its development, that this curvature is, in almost all cases, the result of an increase in the vital energy, and consequently in the physical development, which the muscles of the left spinal hollow and of the right shoulder acquire, from the habit early taught to children, of making use much more frequently of the right than the left hand. In this way, the mass of muscles on the right side (trapezoid, rhomboid, angular, posterior superior serrated, of the right side) which fix the shoulder blade, in order to afford a firm point of support to those of the right arm, overcome the action of their antagonists.

It is developed so much the more readily according as to the general rather than predisposing cause which I have first spoken of, is joined any particular exercise operating in the same direction, as that of the harp or other instrument of that kind.

It has been very wrongly said that "if muscular predominance determined curvatures, they would be more frequent among very strong and well-exercised persons than amongst weak ones; first because exercise and development are always unequally distributed between the two halves of the body, and next because the amount of the difference of energy between the two sides of the body (a difference which is considered as the power which bends the spine) would necessarily be the greater in proportion as the whole force is powerful. We observe, however, directly the contrary; for individuals in whom the muscular powers are much debilitated, may be said to present exclusively curvature of the spine."

It is, on the contrary, evident, that, precisely in proportion to the general debility, will be the demand for a strenuous and fatiguing employment of different muscular masses on both sides, the consequent unequal development of which will be the main cause of deformity.

From all that has been said in the three preceding chapters, it appears that the causes which most generally produce these deviations are numerous; but the principal cause is an influence or power without the spine, continually acting on one or several parts of it, in a determinate direction always the same, either because external pressure is exercised, or because the equilibrium of the powers which act on the vertebral column has been disturbed, or because a bad attitude, brought on by habit or a particular kind of labour, has at length altered the form of the vertebræ by a constant pressure on certain points of their surface, which renders nutrition less active there, while the other parts have preserved their activity; all which necessarily produces an inclination of the spine on the thinner side, which becomes hollow, while the other becomes more salient.

CHAPTER VII.

ACCESSORY DEVIATIONS.

These are either vertical or rotatory.

As to the former, it is seldom that the curvature is single; that is to say, that there is but one dorsal curvature; most commonly there are THREE CURVATURES: one to the left in the lumbar region; one to the right in the dorsal; and one to the left in the cervical.

Generally, even before a lateral deviation in the dorsal region arrives at the degree which has been described, there is lumbar and cervical deviation in other directions. The brief history of their most usual genesis is as follows. There being a slight curvature of the dorsal portion of the vertebral column, opposite curvatures are consentaneously produced above and below the first, to maintain the equilibrium, and render the upright position easy.

The muscles of the vertebral hollows acting on the spine, those of the abdomen acting on the ribs, and those of the inferior extremities inclining the pelvis, are the causes determining the secondary deformities. The muscles of the vertebral hollows, after having been remarkably enervated by the changes supervening in their relations, are susceptible of recovering a portion of their contractibility and their nutrition, in consequence of the efforts excited by a feeling of the necessity of re-establishing the equilibrium.

As to the ROTATORY DEVIATION, I need only further add, that every one knows how difficult it is to stand motionless in an upright position, or sit up without support, even for a short time, because the muscles need intervals of rest to preserve their energy. When they are forced to act constantly, they soon become fatigued, and would completely lose their power, if we did not assume an attitude capable of giving them rest and support—without, however, materially altering the former position.

It is necessary, then, to call the accessory muscles into action; but, as they have not so favourable a direction, we are obliged to incline the vertebral column so as to give to the lever for their insertion a shape favourable to their action; and, as the articulating surfaces do not permit the spinal column to bend in a direction completely lateral, the vertebræ perform a rotatory movement from right to left, or from left to right, gliding on one another, which produces the twisting that always accompanies lateral deviations in a way more or less marked; so that its anterior part is, in its two halves, in an opposite direction.

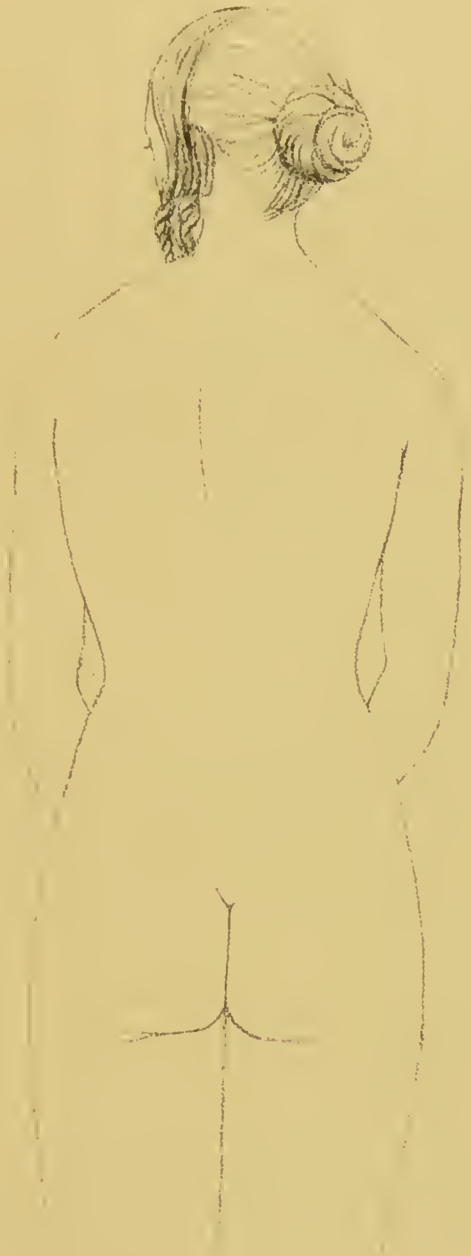
In this case, the transverse process on the side of the convexity is carried back, while that of the concave side thus becomes more anterior; the anterior surface of the body of the vertebra has no longer an opposite correspondence with the median or anterior line of the thorax: the lateral surface of that body, on the side of the convexity, has approached the concavity of the ribs of that side; and finally, the whole body of the vertebra appears situated more in the great cavity within one side of the breast than between the cavities of both sides.

To conceive the cause of this extraordinary mode of derangement, it is necessary to imagine, that in a well marked curvature of the vertebral column continuing to sustain the weight of the body, the vertebræ of the middle of that curvature are, in fact, in the same situation as if they were urged by a direct and horizontal force on the side of the concavity, towards that of the convexity. In this impulsion, the body of the vertebra, isolated in its anterior and lateral parts, experiences no resistance: but the articular processes are powerfully restrained by their reciprocal connection. The transverse processes find, in their articulation with the tuberosity of the ribs, a resistance to their deviation, which would be very weak on the part of an isolated rib, but which becomes considerable by its union with the adjoining ribs.

It results from this exposition, that, behind the central part of the dorsal column, there is efficacious resistance to its lateral displacement; that before this central part there is no resistance to that displacement; and consequently the vertebra must necessarily turn on its axis to arrive at the position which observation so frequently presents.

After the exposition of these changes wrought in the shape of the ribs, it is evident that those which correspond to the concavity of the curvature being straightened in their posterior portion, arc so much the more elongated, and thereby pushed towards the sternum.

15.



Left Lateral Curvature

CHAPTER VIII.

LEFT LATERAL CURVATURE—LUMBAR CURVATURE—CURVATURE BACKWARDS—CURVATURE FORWARDS—ALL MOST COMMON AMONG YOUNG WOMEN.

The left lateral curvature, which takes place in the same part of the column as the right, is effected under the influence of the same causes acting on the opposite side, and in exactly the same manner. It is observed among the majority of persons called left handed, which confirms the truth of the strictly physiological explanation just given concerning the right lateral curvature.—See Figure XV.

"I know," says Beclard, "several left-handed individuals well formed, and who all have the left shoulder, together with all the limb belonging to it, a little more developed than that of the opposite side, and at the same time slightly raised."

The existence of a great number of individuals who are left-handed, without presenting the curvature to the left, far from being opposed to my opinion as to the cause of these two kinds of deformity, merely proves that with them the continual action of the left arm has never been carried so far as to make it affect the spinal column, for it is rare that left-handed people so frequently use their left-hand, as the majority of persons commonly make use of the right.

Deviations of this kind frequently result from a defect of physical education, that is, are produced by standing allowed too soon, or by the vicious positions which nurses give to children, either while carrying them or while conducting them by the hand.

This last cause is very apt to determine the vertebral deviation to a left convexity: this is the case we observe most frequently, and it is also that which might be expected.

A very great majority of cases of right lateral deviation of the spinal column, says a French orthopœdist, is independent of all morbid affections of the bones, of its fibro-cartilages, or of its ligaments: it is the contrary in left lateral deviation, and in all which alter its form in any other direction. The importance of this distinction is very considerable in the treatment of these deformities.

After the right lateral curvature in the dorsal region, the lateral LUMBAR CURVATURE is the most common. It results from the bad habit which some children very early acquire of leaning on one of the sides of the pelvis.—See Double Curvature, Fig. XIII.

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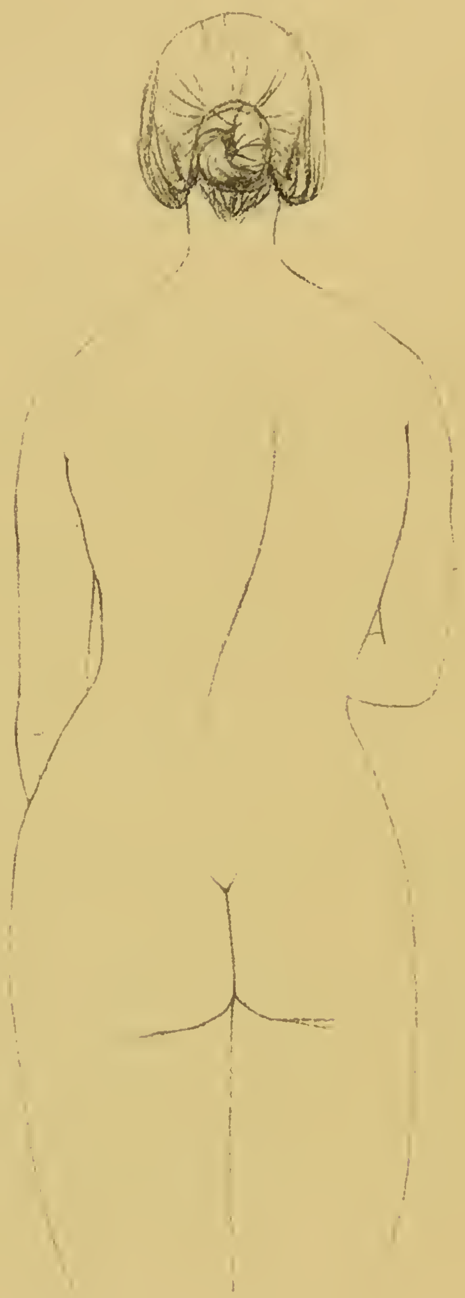

Double Curvature

This curvature differs from the preceding in this respect, that the column is drawn out of its proper position by the lowering of the breast produced by the contraction of all the muscles which go from the ribs to the circumference of the pelvis.

If the curvature is observed almost as frequently in young boys as in young girls, it is infinitely more dangerous with the latter; for, when once the muscles which have brought down the breast laterally have by the continuance of their action, acquired great energy, they at length raise the pelvis on the side of the curvature; an unfavourable circumstance, which also results from the efforts which the patient makes to bring back to the right the centre of gravity which is continually bearing to the left side, or vice versa, and which may be injurious in accouchment by producing an improper direction in the axis of the pelvis.

This species of curvature is also observed to attack some young girls whose lungs are or have been the seat of some affection. When this is the case, the head is lowered, the back is curved to weaken the motions of respiration and to diminish the pain which would be occasioned by too great a horizontal dilatation of the breast, and they grow in this bad position, which is observed in a great number of consumptive patients.

I have said that the spinal column may have the CURVE BACKWARDS under the mere influence of certain muscles. It is generally backwards, that is, behind the line representing the centre of gravity of the body, that the centre of this curve is placed. It occurs almost always in the dorsal region, and in general is only an exaggeration of the natural curvature backwards which the column presents at this part, with loss at first, but subsequently with increase, of that of the cervical region, which is opposed to it. —See Figure XVI.

This curvature is observed in the majority of aged country people, particularly gardeners who are obliged habitually to bend the body very much forwards. In them, the extensor muscles, being constantly in action, lose their power, and seem to leave to the ligaments alone the office of supporting the weight of the body; and the vertebræ, continually pressed on one another at their anterior surfaces, become thinner at these points, and ultimately solidified in this position, to such a degree, that if they remain so long, it is impossible to make them straight again.

This deviation which may become extensive and form a real hump, occurs also very often among girls who increase quickly in stature, and who, during this growth are allowed to assume bad positions, such as are necessary in embroidering on very low frames, or still more frequently in writing on low tables, which

16.

Curvature Backwards.

occurs in the generality of schools, when the mistresses would think they showed too much condescension, or a sign of weakness, if they did not subject to rigorous uniformity, all the young persons about the same age entrusted to their care.

There occurred, in the practice of a French surgeon,* the case of a young girl from ten to twelve years of age, who, having worked with extraordinary emulation, for several months only, to overtake and surpass her companions, being constantly bent over the table where she wrote and drew, and having grown several inches in that time, presented a very manifest bending forwards of the trunk, or a curvature of the spine backwards. Examination of the parts showed that the motion of the spinal column was free, and that it was perfectly well formed; but that its complete restoration to straightness was vigorously opposed by the resistance of the abdominal muscles which were strongly contracted, and could not be again stretched sufficiently.

As even those girls whose spinal columns curve backwards also use the right hand oftener than the left, it follows that the projection forming the centre of the curvature, is always directed a little to the right: accordingly the majority of hump-backs are inclined to that side. This curvature or hump-back, is the kind of deformity which is most easily con-

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* Dictionnaire des Sciences Medicales, Art. Orthopedique.

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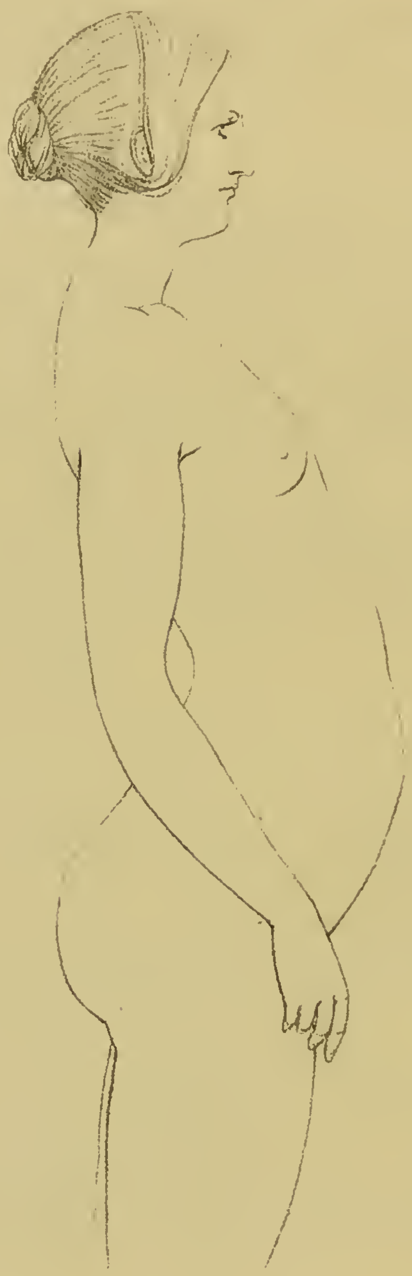


Curvature Forwards

over the hips, is very frequent also with young girls who limp from deficiency in the length of one of the legs. Desiring to conceal the deformity, they acquire the habit of bending the sound leg, so as to render it equal to the other; but as it is impossible to have one or both legs long bent, without a strong propensity in the body to bear forward, they produce a strong contraction in the muscles of the lumbar part, and thus arch their figure.

The same thing takes place in pregnant women, particularly towards the close of pregnancy, when the weight of the abdomen always tends, whether in standing or sitting, to bear forward the centre of gravity of the body, and when the articular tissues of the lowest lumbar vertebræ very often participate in the state of relaxation which at that epoch, is experienced by the ligamentous parts by which the different pieces of the pelvis are united to one another.

Happily, this deviation, to which the lumbar vertebræ have a natural tendency, is rather uncommon, and is not often strongly marked when it is not aggravated or occasioned by an alteration of the vertebræ; for the projection which results from it in the lower and posterior part of the abdominal cavity, is very apt to injure free development in pregnancy, and to produce an obliquity. It may even prevent delivery, or make it seriously complicated, either by reducing the space of the pelvis which is immediately above the sacro-pubian diameter, below the requisite extent, or by giving an improper direction to the contractions of the machine.

It is easy to conceive that the different kinds of curvature of which we have treated, must be infinitely more common among girls than among youth of the other sex, and this for two reasons: first, that boys, in the great variety of active exercises which constitutes the majority of their games, find means of establishing that equilibrium, which the bad habit of using one arm more than the other, or of stooping to write or draw, tends incessantly to destroy, between the antagonist muscles whose contractions draw the column away; secondly, that the constriction which corsets exercise on the lumbar region and the inferior half of the dorsal, among girls, causing the muscles of this part to waste, or opposing their action and development, deprives the column of the greater part of its power of resisting the various forces affecting it, and thus permits it to yield more readily to the tractions it experiences in different directions by the muscles which are free from the compression of the corset, as those attached to the anterior part of the bodies of the vertebræ, or those connecting the base of the chest to the pelvis.

CHAPTER X.

CONSEQUENCES OF CURVATURE.

When curvatures of the spine are once produced, there result symptoms more or less serious, arising from the constraint of the organs, which is always proportional to the extent of the deformity, and the period of its appearance.

When the deviation affects only the dorsal part, there is a little constraint or less facility in respiration, and particularly less elegance in the motions of the limbs. But if the deviation is considerable, if it affects at once the lumbar and cervical parts,—then the results become serious; the longitudinal diameter of the trunk is diminished; the cavity of the chest is contracted by the twisting of the ribs and their difficulty of motion; the diaphragm, pressed on the abdominal viscera, can no longer be lowered, and thereby give amplitude to the chest; hence, an habitual restraint in respiration and circulation, dyspnœa and palpitation of the heart, the feeling of oppression and suffocation experienced by patients when they wish to walk or make other motions, rather quickly.

The organs contained in the abdomen are compressed by the lowering of the diaphragm and by the projection of the transverse lumbar processes, which causes them to bend forward and distend the abdominal parietes, the muscles of which are relaxed by the approximation of the points where they are attached, an arrangement which produces the projection of stomach observed in hump-backed persons. This compression of the abdominal organs very well explains the different diseases of the stomach, liver and kidney, to which persons of deformed figure are subject.

When the deviations are not complete until an age when the bones have already acquired a tolerable solidity, the pelvis does not become deformed, or at least very little: hence, we frequently see women, otherwise very deformed, have an easy accouchment; while the accouchment of others is extremely difficult, and even impossible by the natural modes.

When the vertebral deviation, on the contrary, has begun early, the weight of the body and the muscular action operating unequally on the two sides of the pelvis, the diameters of that cavity are much deformed; it is particularly the antero-posterior diameter which loses most breadth. Accoucheurs possess means of determining in an exact manner the extent of these diameters.

These curvatures do not confine themselves to opposing the free execution of the acts of locomotion, and to producing the most frightful deformities; by modifying the extent of the chest, of the abdominal cavity and of the pelvis, they also effect an extensive alteration in the whole economy, by the disturbance which they introduce into the action of the organs of digestion, respiration and circulation; and, thus viewed, no deformity is more entitled to the whole attention of the physician.

PART III.

TREATMENT OF DEVIATIONS.

CHAPTER I.

TREATMENT OF SLIGHT AND TEMPORARY DEVIATIONS.

In common circumstances, cessation of the causes is alone sufficient to remedy the deformity. We ought therefore to discourage, in the beginning, the bad habits which children appear inclined to contract, and to abstain altogether from leading-strings, conical baskets or go-carts, arm chairs, &c., which tend to elevate the shoulders. We may draw assistance from gentle auxiliary means.

We may even accomplish the same object of raising or lowering the shoulders, by making the patient walk with a tall stick on the side of the lower shoulder, or a very short stick on the side of the higher, and other like means. Authors have recommended the use of a stay, having the opening that corresponds to the depressed shoulder, more elevated than the other; but children soon habituate themselves to the species of constraint which this causes them. They do not, however, consider that, in many cases, it is not the depressed shoulder that requires raising; but very often the high shoulder that needs depressing.

If a child has contracted the habit of almost always standing on one leg, and keeping the other in a state of inaction; it is evident that we can in this case prevent, and even correct the effect which must follow from this habit, by making the child in the first place stand continually on the opposite foot, if the shoulder is already lower; and afterwards on both feet equally, and the body quite straight.

It is for this reason that when the arms fall forward, we ought to hasten to remedy this deformity immediately after it has commenced, by a frequent repetition of such exercises as are best adapted to carry the shoulder backwards, such as skipping backwards, &c. &c.

Children should also be made to lie flat on a hard bed.

All these means do not always accomplish the desired end, therefore, I give a decided preference to continual watching, the removal of the causes, and above all gymnastic exercises, &c.

CHAPTER II.

TREATMENT OF LATERAL CURVATURE. — EXTENSION AND MECHANICAL MEANS.

The deviations of the vertebral column, assuredly are never spontaneously cured, if the circumstances in which they are produced do not change. On the contrary, if nothing is done to counteract them, new causes are added every moment to the first, increasing the extent of the arch which the column describes. Indeed, according as the column is thrown out of place, the muscular bundles which correspond to the concavity of the curvature are inserted into the displaced vertebræ at a greater angle, thus acquiring additional force; whilst the direction of their antagonists, becoming parallel to that of the osseous surfaces in which they are inserted, their power is very much diminished or even reduced to nothing. The existing deviation, moreover, continually favours a new deviation. The digestive, circulatory and respiratory functions, becoming more and more difficult, the organs gradually lose their force and yield with more ease to the action of the circumstances which have produced the deformity.

Profiting by these alarming circumstances, and guided rather by the love of gain, than the interest of science and the love of public good, the mere mechanical practitioners have always persisted in mistaking the true cause, under the influence of which this curvature ordinarily supervenes.

They have, indeed, been capable of observing that the best means of refreshment after long fatigue is repose, and that, in this respect, the advantage of the horizontal position is evident; and this fact they have turned to account, adding to it extension and pressure. For them, it is in vain that, in determining the functions which the spinal column performs in animal mechanics, the ablest surgeons have proved that, in deviating from its natural straightness, it, in the greater number of cases, yields only to the irregular action of those muscles to which it affords insertion either direct or indirect, and that, this being the case, we ought to endeavour to restore it to its proper form only by putting into action the muscles which are the antagonists of those which have acted unfavourably. Mechanists seem to have always considered it as a body unaffected by muscular power, which having become curved merely under the weight of superincumbent parts, cannot be restored to its natural form, except by the assistance of some machine acting either by pressure on the centre of the curvature, or by drawing back its two extremities. Accordingly, they have not furnished one single well authenticated instance of cure, and, in many instances, the employment of their methods has occasioned the most mischievous effects.

Let us examine then, how far this method is capable of fulfilling the therapeutic indications resulting from an exact knowledge of the causes of each of the two kinds of curvature which we have described.

When these causes are internal, this method is so palpably injurious as scarcely to be worthy of the slightest notice.—In this case, these indications must vary according as we examine the spinal column at the commencement of the curvature, that is, at the time when the alteration of the vertebræ or of their fibro-cartilages is only the symptom of a general affection, or according as we observe it when it is curved, either by the disappearance on one side of the fibro-cartilages, or by the union of the altered vertebræ into a single mass. In the first case, it is the exciting cause that we must combat; and all that can be done to the side of the spinal column, is to establish a permanent irritation on the skin to counteract the inflammation of the diseased vertebræ; but absolute repose of the column is indispensable, for every movement imposed upon it, will only tend to aggravate the disease, by creating irritation, and keeping it fixed upon those parts which are affected.

Let the practitioner never forget, that in a disease which consists in the softening of bones, the solidity of the insertion of muscles and ligaments is much less than in a natural state, and that these organs may be detached, either by a simple separation, or by a tearing away the portion of the osseous surface where they are inserted, and that the slightest effort is sufficient to detach them altogether. We have, then, reason to fear that pieces of the spine may be detached by the use of extension. This danger is much more imminent when, in cases of this kind, the principal deformity is seated in the cervical region, or is prolonged to it; the articulation of the head with the first two vertebræ affording much less security in this respect, than that of other vertebræ with each other.

When these causes are external, the method is absurd. — However varied and of whatever nature the power employed to effect extension of the spinal column may be, their common result must be the farther removal of its extremities from each other, and consequently its extension at the expense of its curvature; and this first effect of extension has nothing in common with the curvative indication which naturally springs from the diagnostics of curvature of this kind, since this indication ought above all to have relation to the cause, and that extension is directed solely to a favourable result.

The reasoning employed in this case is conspicuously bad. "Even admitting," say they, "what we have proved could not even be supposed, that nearly all the deviations in question ought to be attributed to the weakness of certain muscles, it is not more logical, medically speaking, to affirm that it is above all things necessary, in order to correct them, to strengthen these muscles, than it would be to say, in a case of dislocation induced by weakness of the ligaments of articulation, that before beginning to reduce it, we must strengthen these ligaments.

"The aptness of this comparison appears to us the more obvious as there are in the two cases, whatever be their causes, the same symptoms to be primarily disposed of, that is, to surmount the organic obstacles which consist, on the one hand, in the alteration of the forms of the parts composing the spinal column, and on the other, in the irregular relations of the articulating surfaces of the limb; plain facts which in both cases constitute mechanical obstacles, which must be surmounted by treatment of the like nature.

"It is thus, however, that our contemporary has reasoned: our readers will be able to judge of the merit of his hypothesis. As to ourselves, we do not hesitate to declare it radically wrong, founding our opposition to it on this reasoning, which to us appears evidence itself, that the first thing to be done, in a case of deviation of the spinal column, of whatever description, is to surmount the obstacles, which actually oppose its straightening: in the same manner as in a dislocation of a limb, the first thing to be done is to surmount the obstacles which are actually opposed to its reduction; seeing, that if, in both cases, these obstacles are only mechanical, and independent of all internal affection (a supposition already admitted, and on which supposition alone we reason), the action of mechanical means tending to surmount these obstacles, is the first means requisite, and the only one which can be efficacious."

The persons who argue thus take great pains to demonstrate their own folly. There is no similarity in the two cases. In strengthening the muscles, we remove the cause: in strengthening the ligaments we only remove an effect.

But it may now be asked—Are all the parts of the spinal column capable of equal resistance to extension? The reply must be in the negative. The dorsal vertebræ have a second articulation with the ribs, uniting them more intimately, and the lumbar are covered with a great quantity of articular and muscular bundles; but the cervical have none of these means of resistance. Accordingly, the latter more particularly are affected by extension, which is quite contrary to the desired result, since it is the vertebræ of the dorsal region that are most apt to deviate from the natural direction, and are consequently those to which the greater extension ought to be applied.

What, then, must happen from the employment of this extension, but that, as soon as the column is withdrawn from the action of the extending powers, it will yield to the active effort of the muscles, which first turned it from its natural straightness, and which will now have so much the more power as the column will be less able to resist? for the lengthening takes place only because the parts which unite the vertebræ to one another, and more particularly the intervertebral ligaments, have been distended by continued pulling. The inevitable effect of this prolonged extension is to augment the yielding mass of the whole column, by facilitating the isolated action of the twenty-four pieces of bone which compose it. This unfortunate result of muscular action will be even still more aided by the pressure of the superior parts of the body, which, in the column thus stretched, will no longer find a support sufficiently solid.

Compressed in part, and deprived of movement, muscles soon become languid, diminished in volume, and incapable of making any effort, or of fulfilling any function. Supported erect only by adventitious aid, and then perhaps presenting a rather favourable appearance, these parts, when left to themselves, fail not gradually to sink down, and consequently to present much more extensive deformities.

As to the power which may be attributed to extension, of weakening the preponderating muscles, and thereby restoring to the column the power of assuming its natural form, it is evidently quite chimerical; for the extension is felt equally by the weak muscles as by those whose action is predominant; and even supposing (which is certainly not the case) that these last more particularly experienced its effects, things would remain in just the same state, because the column, having become curved only by yielding to an active power, would not straighten itself, except under the influence of another power, which should be equally active, and diametrically opposed to the former, but which ought to be so much the stronger, as the curvature is of long standing, and well marked. It is therefore very easy to perceive that, especially in the commencement of the disease, the sustained exercise of the weak muscles, and the repose of those which predominate, fulfil the principal condition requisite for the cure of curvatures by muscular action, and that extension does not fulfil any one of them.

Hitherto, we have reasoned on the hypothesis most favourable to extension, for it has been combated, by supposing the possibility of its execution: but it is not so; for one of two things must take place; either extension is moderate, and then its effects are insufficient for the cure of the deformity; or it is sufficiently powerful to effect the straightening of the column, and then it may be followed by consequences which may be suddenly fatal.

In relation to these consequences, we have seen a young girl who, after a treatment of ten months, had the column perfectly straight when under extension; but, when extension was removed, the trunk sunk again, and the deformity appeared greater than before, as might be proved by comparison with a plaster bust modelled upon her at the commencement of the treatment; and which is explained by the stretching of all the fibrous tissues by the apparatus.

We have also observed, after two or even three years of treatment, during which the height of the figure had encreased considerably, that the upright position could not be maintained without crutches, and, on the removal of these supports, the body sank as much or more than before. The crutches therefore became thenceforth indispensable.

Extension, therefore, will ever be hurtful, if employed to correct a mere defect of carriage which may be easily cured by active watching, or properly directed gymnastic exercise.

In relation to the vital system, there are instances of curvature which might render any experiment of extension infallibly mortal. Such is that where some of the soft parts have not followed the development of the vicious inflexions of the column. Thus instances of deformity have been seen in which the aorta had accommodated itself to the abnormal incurvations of the column, whilst the œsophagus formed a right line from the pharynx to the diaphragm, and was only three or four inches in length.

We may also ask, can numerous vessels and nerves in the cervical region be continually on the stretch without danger to their action and texture? May not extension, by destroying the numerous windings of those blood-vessels in the neighbourhood of the head, cause the blood (already driven from without inwards by the compression exercised by one of the extremities of the machine) to rush to the brain with such force as to occasion disastrous consequences?

To be convinced of the reality of this danger, it is sufficient to observe the face of young girls under the operation of extension, covered with a redness which in some approaches lividity and is sometimes accompanied by a violent head-ach, and a sparkling of the eyes, which is often a precursory symptom of apoplexy. Do not the Orthopedists themselves regard a certain degree of redness of the face, as one of the most important of those signs which point out the imprudence, even on their part, of carrying extension further, or of continuing it longer?

All persons who think that prudence ought to guide them in the practice of medicine, will find that under cover of a proposition so vague, and affording so little warrant for imitation, very inhuman conduct might be observed in many cases, since we see constantly individuals horribly deformed live a long time, and keep themselves in a tolerably healthy state.

But the effects of extension on the nervous system may be most frightful. It must not be supposed, that extension is even operated in a slow and gradual manner. How much more are all these serious evils to be dreaded, when the extenders or stretchers inculcate the following practice: "moreover, it is requisite to modify extension in such a manner that it may operate rather by jerks than by a slow and progressive stretching."

A French surgeon was consulted on account of a young person subjected to mechanical treatment for a long standing deformity of the spine, in whom a very remarkable phenomenon was observed, when extension had been carried far, which in the sequel became permanent—I give the expressions used by him.—On the first attempt of extension on a horizontal plane, "the increase of stature was carried very far in a few hours." But immediately a nervous affection supervened, which forbade extension the next day. This affection went off by repose: "but it left an alteration in vision, which some authors call double-sightedness, and which encreased in proportion as the treatment was prolonged. As soon as the young lady was placed on the mechanical bed, something like contraction of the skin of the middle of the forehead took place. This kind of constriction sent out a number of radii to the eyelids and temples. Then specks and different colours appeared to surround objects."

The following case was more fatal.

Miss D—, 17 years of age, came to Paris to place herself under treatment, having lately been affected with deviation of the spinal column. She had been seized a year before with acute rheumatism, of which, some time previous, she had been perfectly cured. She enjoyed very good health and a remarkable freshness of colour, and was otherwise well, when about the beginning of May she came into the house of Messrs. ———.

On the second night of her arrival, Miss D— was placed on a bed of extension, but she soon experienced such exquisite pains, that it was necessary to undo the screws and place her in an ordinary bed.

They did not stop at this first attempt, and Miss D— was, on the following night, again put on the bed of extension.—This time, the result was more quickly painful, and was otherwise more serious, for when taken off the bed, this young person had lost the use of her right arm and leg.

A violent fever soon supervened, accompanied by very severe pains along the whole length of the spine and in the brain; speech and motion of the thoracic and pelvic organs on the right side were lost; the intellectual faculties gone, &c.

Drs. A. and B. were called to consult on the danger of the case, and succeeded in allaying the pains and fever by bleedings, ice on the head, cold applications, moxas, &c., which they prescribed; but these means were ineffectual in removing the paralysis and loss of memory. Ultimately, Miss D—, however, recovered the habitual colour of her cheeks; her general health was also re-established; but the functions of intellect and of the organs of motion were lost without hope of recovery.

If then the cervical ligaments relax, and they might do so suddenly under the most ordinary extension at a moment when least expected, extension may thus determine the luxation or at least the commencement of the luxation of the odontoid process, and occasion the compression of the spinal marrow and instant death.

Is it not thus, that children inadvertently suspended by the head, have met their death? Yet what more was done to them, than stretching the neck from the weight of the body, in the same manner as some of the machines of extension act, however complicated, or perfect they may be? Now, may not the continuance of extension do in the end what the weight of the body, multiplied by its velocity of elevation, will do instantly? The stretchers persist in not being able to conceive the possibility of such a danger. But, to employ a comparison which will doubtless be better understood by them, we may tell them that rabbits are habitually killed in this very way— by luxating a cervical vertebra by the extension of the spinal column, placing one hand toward the base of the head and the other on the pelvis? The consequence of this operation, which is so speedily fatal, does not require, as we know, a very great effort; and if, after the death of the animal, the spinal canal is opened, we see with astonishment, that the spinal marrow has suffered no alteration physically appreciable, especially when the animal has been killed by an experienced hand.

In whatever manner, then, we examine beds of extension, we find no real reason which can indicate the necessity of their use in curvatures considered generally, and nothing, absolutely nothing, which can induce us to reverse the extremely unfavourable judgment which the best surgeons of the day have long entertained respecting the ideas on which they have been constructed; on the contrary, we see nothing but good reason to fear for the health and even life of the patients submitted to their action.

In the General Archives of Medicine for 1825, we find that the French Academy thought it not only their duty to denounce the principle of extension for straightening the spinal column, but further that many members loudly proclaimed the insufficiency of such mechanical beds, and that others cited cases where the employment of them had been followed by most disastrous consequences.

Parents may therefore spare the great expenditure of mechanical genius in pretended improvements in the construction of mechanical beds, which, like a universal panacea, were to cure infallibly all the patients who had courage to lie down on them and to submit themselves patiently and blindly to the torture of the winch, and to the inertness in which they were left for months and even whole years—during which they were condemned to remain on these beds of agony. Such a display of apparatus, such rigorous treatment of the patient seemed in truth invented to cover ignorance, and justify the enormous price which was exacted in fees; cost being a sort of delusion which acts marvellously on the imagination of the vulgar.

Time, which brings all things to an end, has already considerably diminished the credulity of the vulgar, and will end, we hope, by placing this interesting branch of the healing art in the hands, not of these so called Doctors, but of enlightened and conscientious surgeons, who will treat it in a manner suitable to the interests of science and humanity.

But why talk of principle to mechanists and mechanical doctors? Their principle is to make money; they know no other. Such even is their quickness to seize opportunity, that in France, some have had the idea of strengthening the effect of their machines by religious observances: thus, in an institution in the Faubourg St. Germain, known by the name of the Institution Sacré Cœur de Jésus, they treat hump-back by mechanical beds, to which are added faith, hope, charity, and fastings!

Lately, some experiments have been made on the division of the muscles of the back in cases of lateral deviation of the spine.

They who maintain that contraction of the muscles plays the chief part in the greater number of lateral deviations of the spine, and that these deformities should, in consequence, be treated by tenotomy, have been required by M. Bouvier to prove the affirmative of the three following positions: 1. That in the majority of lateral deviations of the spine, as in deformities really produced by muscular contraction, the muscles corresponding to the cavity of the curvature are rendered extremely tense, when an attempt is made to straighten the spine; 2, That the permanent retraction of these muscles is not preceded in a great number of cases by deformity of the spine; 3, That section or excision of these same muscles on the dead subject causes total or partial disappearance of the curvature.

M. Bouvier decides each of these points in the negative; and thence concludes that curvatures of the spine are not, in the majority of cases, capable of cure by the plan alluded to, and practised by a rival orthopedist of the French capital. The point at issue can, however, be fairly settled only by waiting the results of the operation intelligently performed on the living subject.

A priori, I should be inclined to decide against the operation generally, for two reasons:—1st, because wrong muscular action has, in all these cases, been in natural, habitual and long dependence on wrong nervous action, and therefore division of the muscles attacks the effect only, not the cause, which remains intact; 2dly, the wrong action has been confirmed by habit, which, being unbroken at its source in the nervous system must have a double tendency to renewal.

CHAPTER III.

RATIONAL TREATMENT.

It cannot be too strongly recommended to all who have the charge and education of the young, to watch them with care from the earliest infancy till the age of fifteen or eighteen, to examine them frequently and attentively to see whether their shoulders keep their height, whether they do not become more projecting on one side, than on the other, and whether the spinal column maintains itself in its natural upright position.

When a young person is easily fatigued by the erect position, a reclining one should be recommended to her; and it may be said generally as to position in schools, that the seats for young ladies should be made with backs slightly sloping.

Watchfulness ought even to be redoubled if the individual has experienced any length of illness which could weaken the system, or if any accident has disturbed the equilibrium of the muscular forces, if one of the sides is more or less weak or paralysed, or if one of the inferior extremities is, from any cause, shorter than the other. Those who are the offspring of deformed parents, those who suddenly shoot up in stature, and those who study drawing and music, even the guitar and piano, but especially the harp, ought to be the objects of particular care.

In prevention, those who have some tendency to irregularity of figure, ought, guided by emulation skilfully maintained, to employ their short moments of recreation, in resigning themselves without reserve to such games as skipping rope, hoop, shuttle-cock and other exercises which require continued movements, and in executing which the muscles of both lateral halves of the body take equal part.

When a tendency to deviation becomes evident, it is easy, when taken in time, to correct or to prevent a deformity which might become serious if left to itself. It is undisputable also that, in order to remove the latter, it has been found sufficient to alter the physical disposition of the body and extremities — to adopt a particular manner of lying down, for example. The case has been stated of two sisters who slept together in the same bed, lying on different sides, who became deformed each on the side she lay upon, and who were cured by the simple means of changing sides. If this fact has been correctly reported, it adds much to what is known in this respect, and would alone suffice to show the power of habit and of vicious position.

It is, then, of immense importance to put at once into practice all the means which may be useful as soon as the first symptoms of a spinal deviation are perceptible, and before the muscles have lost their natural relations, and the bones become deformed.

In the right position, muscular contractions are of real advantage; they give to the organs of motion more life, more nutrition, and consequently a greater amount of power. Varied exercises of the body, are the more necessary, among patients afflicted with curvatures, in proportion as these persons are in general deprived of strength of muscle. The medical men most skilled in this department have indeed in their writings and their practice inculcated the necessity of gymnastic exercises in the general treatment of some of these deformities, especially such as have not been caused by a primitive alteration of the parts which constitute the spinal column, but they have recommended them rather in order to revive the expiring energy of contractibility than to destroy inequality in the action of such of these tissues as are formed to counterbalance one another. They have only provided for a secondary requisite; let us provide for the primary one; they have only opposed the progress of the disease; let us endeavour to point out the true means of curing it in a very great number of cases.

The first care should be directed to avoiding absolutely the actions which by their energy or precision require curvature of the spinal column. In the commencement, the spine has not yet become so habitually inclined to one side, as that the vertebræ and vertebral cartilages should, by the pressure of their edges on the side of the concavity of the curvature, have sensibly lost their thickness, and that the muscles should have contracted the habit of always acting in a vicious direction. It is, therefore, easy to correct this inclination, and to remedy the defect of muscular equilibrium.

It is not, however, necessary absolutely to interdict the study of music, of an agreeable instrument, or of an art of imitation, &c.: but, when it is perceived that a child assumes a bad posture in any one of the exercises which compose an accomplished education, it is important, in the first place, to bestow the same care on the person observed, to verify the state of the spine, and to be quite sure it presents no remarkable anomaly in the situation and direction of the pieces which compose it. If, on an attentive examination, a tendency to some deviation of the spine is found to exist, we must not hesitate to put a stop to those pursuits which may add to morbid disposition and accelerate the progress of an incipient deformity.

I hope that by assigning to the different muscles of which the vertebral column supports the action, the share which each may have in the production of curvature, and by reducing all to geometrical data, to be able to prove that if gymnastic exercises, which in the greater number of cases ought to form the bases of the treatment in this deformity, especially at the commencement, have not always been productive of good effect, it is because they have not been prescribed in a distinct manner, and few have pointed out the particular kind of exercise required by each species of deviation.

The principle on which every thing relating to the treatment of a disease of this kind ought to be based, is to act in the inverse direction of the action of its cause. Now, since it is demonstrated that the greater number of curvatures of the spine, whatever their extent may be, result from the action exercised over it, directly or indirectly, by certain muscles which too frequent contraction has rendered stronger than their antagonists, it is natural that the principal point of treatment of the curvature should consist in encreasing the action of those muscles which have yielded to the power of their opponents.

When the deviations of the spinal column are in their infancy, and not yet stationary, and when it is easy by a position of the body opposed to that in which they appear most perceptible, to produce an inverse inflexion, we must, without loss of time, look for the causes and positions on which the deviation depends, that we may remove them, and substitute opposite attitudes and gymnastic exercises, in which the muscles which have a tendency to weakness will be strengthened, and in which the spinal column will, as often as possible, have an inflection the reverse of that which had manifested itself.

Sometimes these deviations have arisen from lying on the same side. In that case, we must take care to make the patient lie on the opposite side. I may add that young persons should be made to lie on a hard bed rather than a soft one, and in as extended a position as possible, with a low pillow, or even without pillow or bolster.

If the incipient curvature arise from a bad habit of standing continually on one leg, the patient should be made to support herself on the other.

If curvature depend upon leaning in writing, drawing, playing &c., a contrary position should be adopted and continued.

In all cases, we must watch constantly, so that, whether the patient is engaged in her usual occupations, or in gymnastic exercises, whether standing or sitting, the spinal column may be, in erect position or slightly inclined, in a direction the reverse of the habitual one.

We may even profit by certain occasions, such as the period succeeding an accouchement, or any other complaint which has required a prolonged stay in bed.

Success has often attended these and other analogous means in preventing, arresting, or completely correcting slight deviations of the spinal column, when they have been employed with assiduity and perseverance; for without these conditions it is impossible to succeed. It is indeed difficult to form an idea, without having actually witnessed it, what may be accomplished by continual care, assisted by a firm resolve on the part of the individual, and appropriate gymnastic exercises.

Gymnastic exercises, adapted to the treatment of deviations of the spine, may be divided into general and particular exercises. The former employ simultaneously almost all the muscles of the body; whilst the latter exercise only one muscular apparatus, the corresponding apparatus being left in repose.

General exercises ought to be employed only against such deviations as are slight, and in their infancy, in which there is not yet a well marked change in the symmetrical disposition of the locomotive agents, and when most commonly all the muscles require to be strengthened and regulated in their movements. They are useful also in convalescents, and when, towards the end of treatment, the deviations are restored to the degree of a commencing curvature.

Particular exercises must be indicated in the course of treatment, calculated to correct the vicious action of a single muscular apparatus; but they may equally be employed before and after this treatment, together with general exercises.

These exercises ought to be repeated several times a-day, but they ought never to last so long as to fatigue the patient. We ought also to commence with those which require the smallest degree of strength, and end by those which require the most. Continuance, and, above all, regularity in these exercises, are essential conditions for their success.

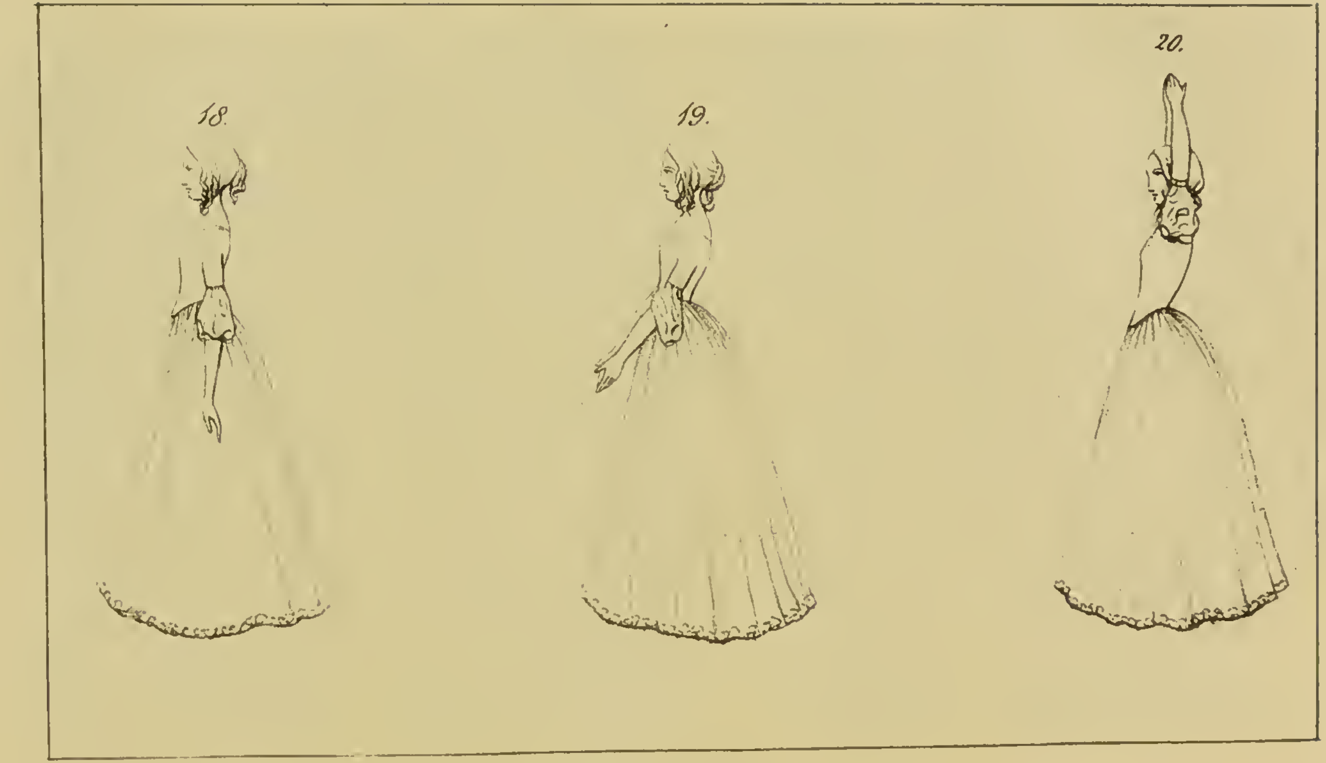
We may cite, amongst the exercises which may be usefully employed in this case, those which some distinguished writers have already recommended, and practised with success. We should, however, begin with the correct position in standing or walking.

Of the Position of the Figure.

That the manner in which recruits are drilled by serjeants, wonderfully improves them, cannot be doubted. The round-shouldered, flat-chested, awkward countryman, can scarcely be recognised in the smart and frequently elegant and gentlemanly soldier.

The only difference which Mr. Donald Walker recommends to ladies, in deviation from the military position, is, that the back be slightly hollowed.

This is forbidden in the British army, on the principle that the soldier cannot so well endure the fatigue of long standing with his back hollowed, as when the vertebræ rest vertically over each other. But, however correct this reasoning may be for soldiers, it does not so rigidly apply to those not thus subject to the fatigue of long standing; and not at all to ladies.



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Exercises.

The general position recommended is therefore as as follows:—The head raised; the chest expanded; the stomach rather retracted; the back slightly hollowed; the knees well pressed back; the toes turned out, at an angle of not less than 45°; the shoulders kept somewhat back; and the arms hanging easily by the sides, with the elbows turned rather in than out—See Figure XVIII.

The upright attitude and almost stiff carriage of individuals, who constantly carry burdens balanced on the head, led Andry to adopt the same means to produce the straightening of the spine. Success has often attended this very simple method in slight deviations, which were not of long standing.

The Extension-Motions.

I here introduce the military extension motions as being, together with the Indian exercises, the most efficient means I am acquainted with, of avoiding or remedying the class of deformities called high shoulder, crooked spine, &c.

The First extension-motion is begun from the position already described, and represented by Figure XVIII. The hands are next brought to the front, so that the second fingers touch, as in Figure XIX. They are then slowly raised in a circular direction, to the position represented by Figure XX, the second finger touching, and the elbows being as much pressed back as possible. They are, lastly, with the thumbs pointing backwards, slowly spread asunder to their greatest extent, or rather as far back as possible, and so brought down to the position commenced from.

The Second Extension-motion is begun from the position shown in Figure XXI. It consists in throwing the arms from this position backward into the position given in Figure XXII, with the wrists turned outward, and the hands brought near the shoulders. This is done with some force, and is repeated rather quickly.

The Third Extension-motion commences from the position of Figure XXIII, and consists merely in throwing the arms backward into the position of Figure XXIV.

The Fourth Extension-motion resembles the third Military Club Exercise; the arms being swung round in it, as the clubs in that exercise.

The British Military Club Exercise.

In these exercises it is indispensably necessary that the person be maintained strictly in the position described before commencing the extension-motions, which is in all respects that of the soldier at the command "Attention," except that the back is more hollowed.

Exercise 1.—Figure XXV shews the way in which the clubs hang by the sides before commencing the exercise. The right club is then lifted

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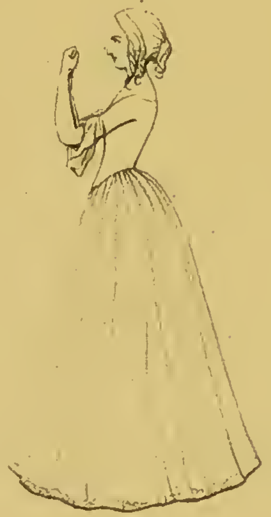

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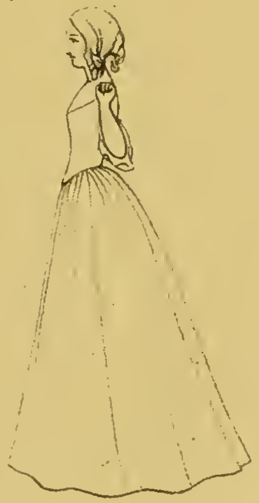

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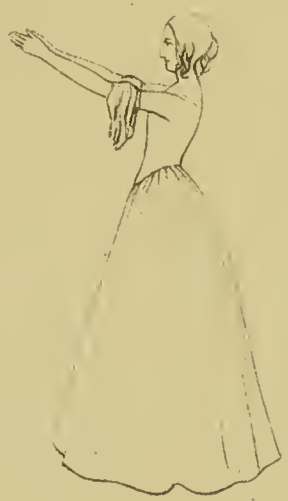

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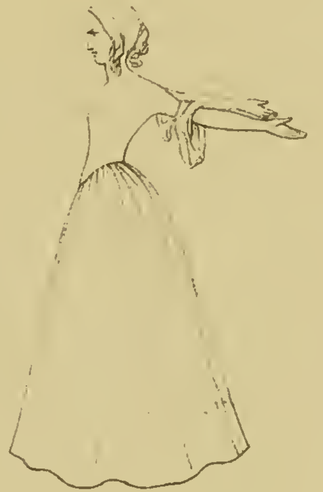

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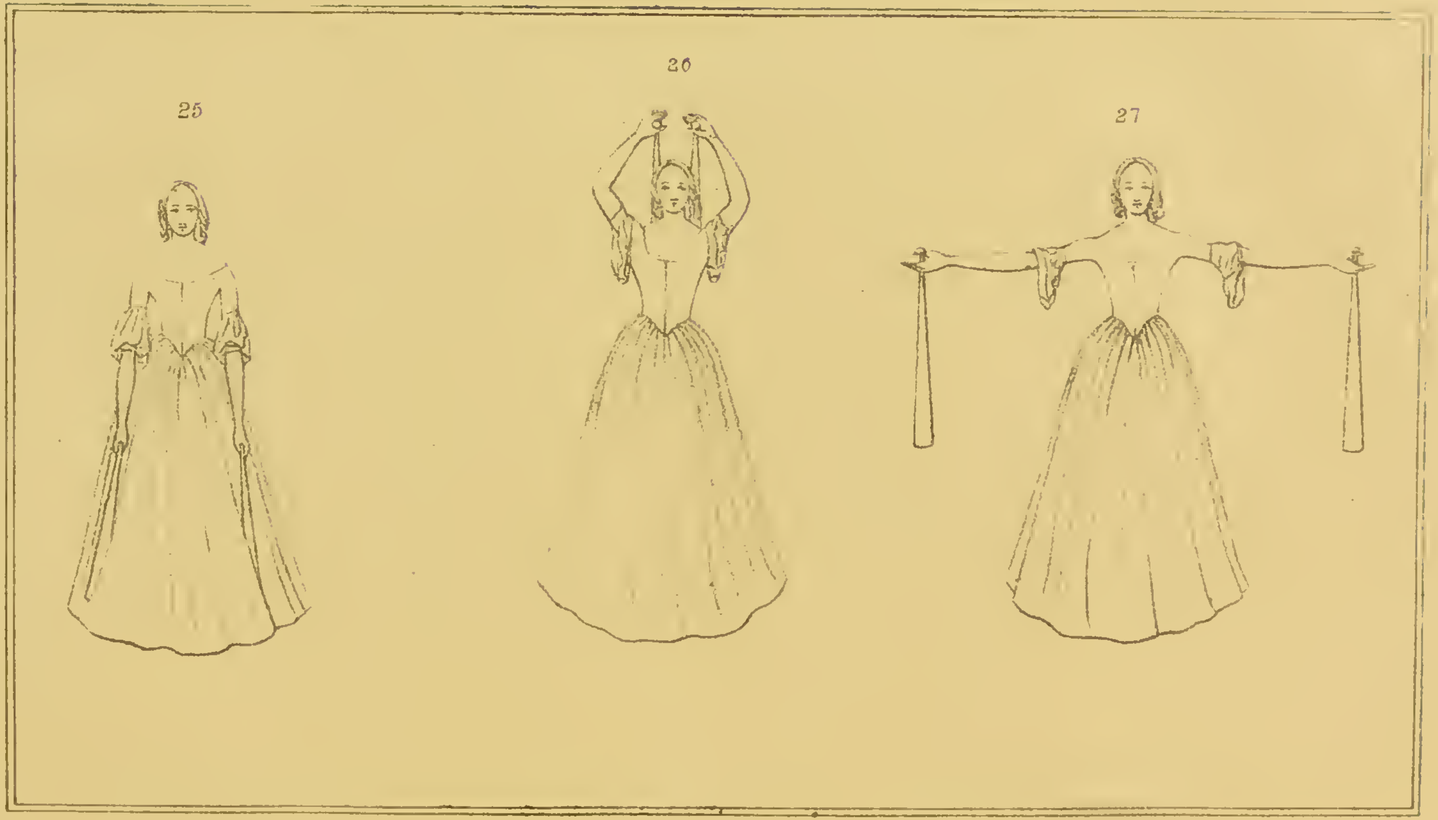

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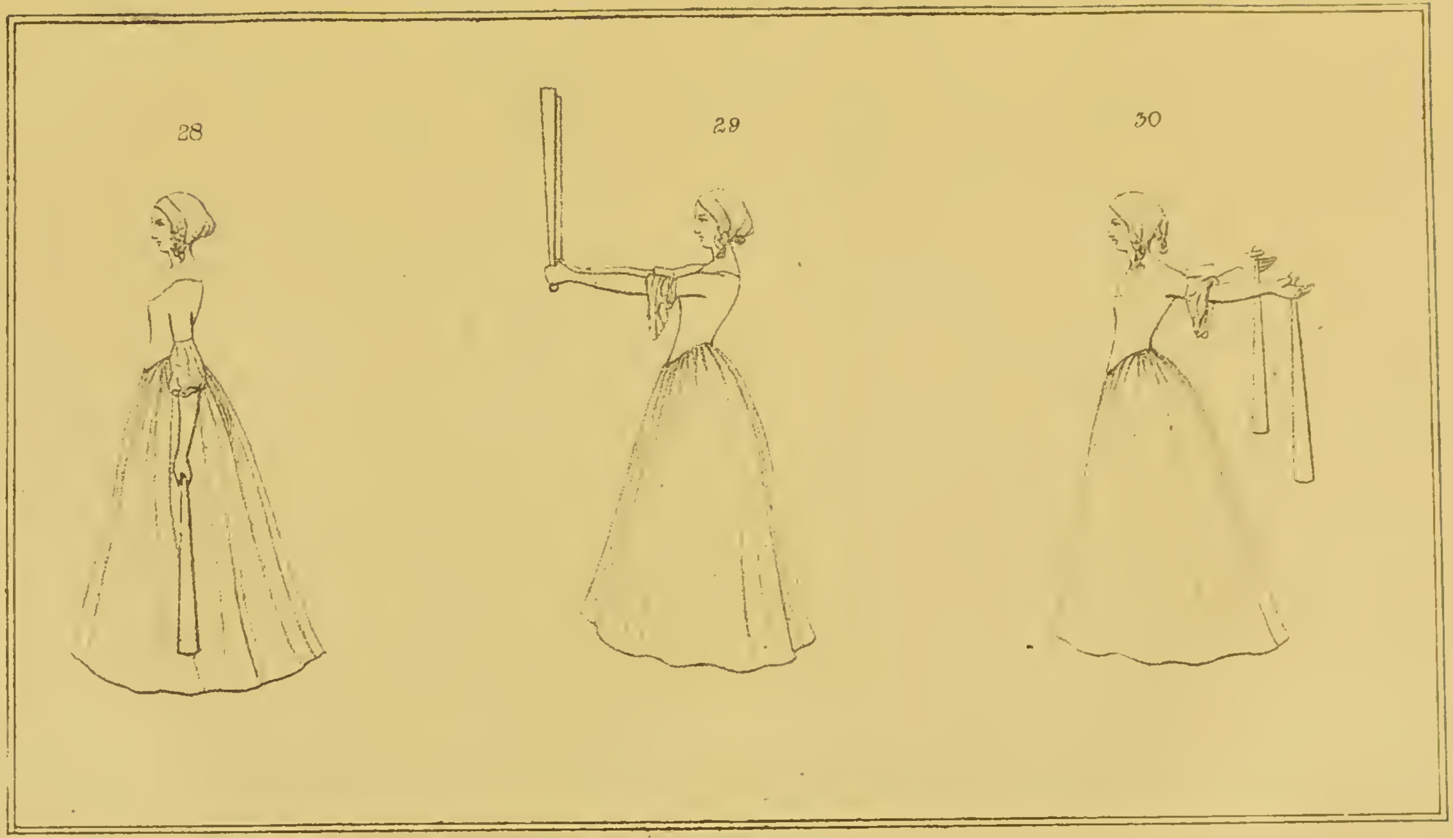

Exercises

over the head, in the line indicated in Figure XXVI, and hangs vertically behind the right shoulder. In a similar manner, the left club is lifted over the head and right club, until it hangs behind the left shoulder, as in the same Figure. They are then slowly spread out, and brought down, as shown in Figure XXVII; the chest being thrown as much forward, and the arms as much backwards as possible. Finally, they come down gradually to the first position.

Exercise 2.—In this exercise, which commences from the same position as the first—Figure XXVIII, the two clubs are at once thrown up into the position shewn in Figure XXIX. They are next spread out laterally, and as far backward as possible, being still held upright. Finally, the wrists being kept at the same level, and as much in the same places as possible, the clubs are, as it were, allowed to fall over backwards, as indicated in Figure XXX. Thence they descend slowly to the first position.

Exercise 3.—Here the clubs are swung round on each side, at arm's length, so as to describe two large circles, in which they pass upwards in front and downwards behind. The arm and club are to form one straight line from the thick end of the latter to the shoulder; for if the elbow and wrist be allowed to bend with the motion of the club, the effect on the shoulder will be lost.—This may be easily understood without drawings.

Indian Club Exercises.

These exercises have been long used in the Prussian army, and have lately been described for the first time, and introduced into this country, by Mr. Donald Walker, in his two works entitled, "Ladies' Exercises," and "Manly Exercises." The most striking difference between them and those in use in our own army, is, that, in the former, the effects are produced by the general momentum of the clubs;—in the latter, by their weight only. Another distinction is, that those exercises, possessing all the advantages of the British Military Club Exercises, add that of suppling the figure, and bending the back.

The First Exercise is begun from the position represented in Figure XXXIII; the feet being slightly separated, and the clubs resting against the forepart of the shoulders. It consists in wheeling or pivoting on the heels, so as to turn each shoulder and side forward alternately, at the same time well bending the back, and sliding the club backward over the shoulder with gradually increasing velocity, till it hangs behind it. The face is turned sideways, so as to look over the wrist. During the turning of the other side forward, this club is gradually drawn back again to its original position, resting against the front of the shoulder.

The Second Exercise is commenced in the same position as the first; and a similar pivoting to each

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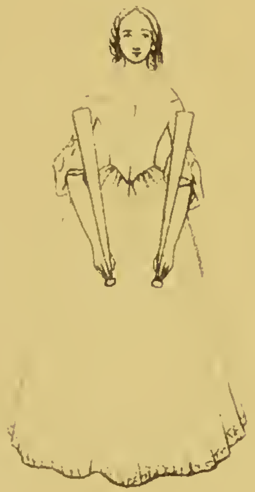

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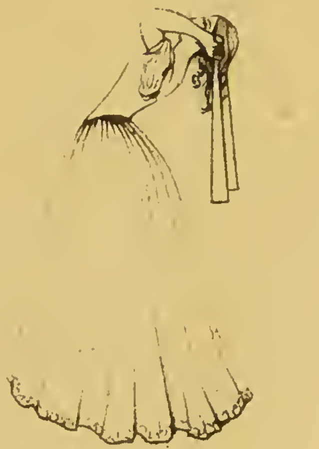

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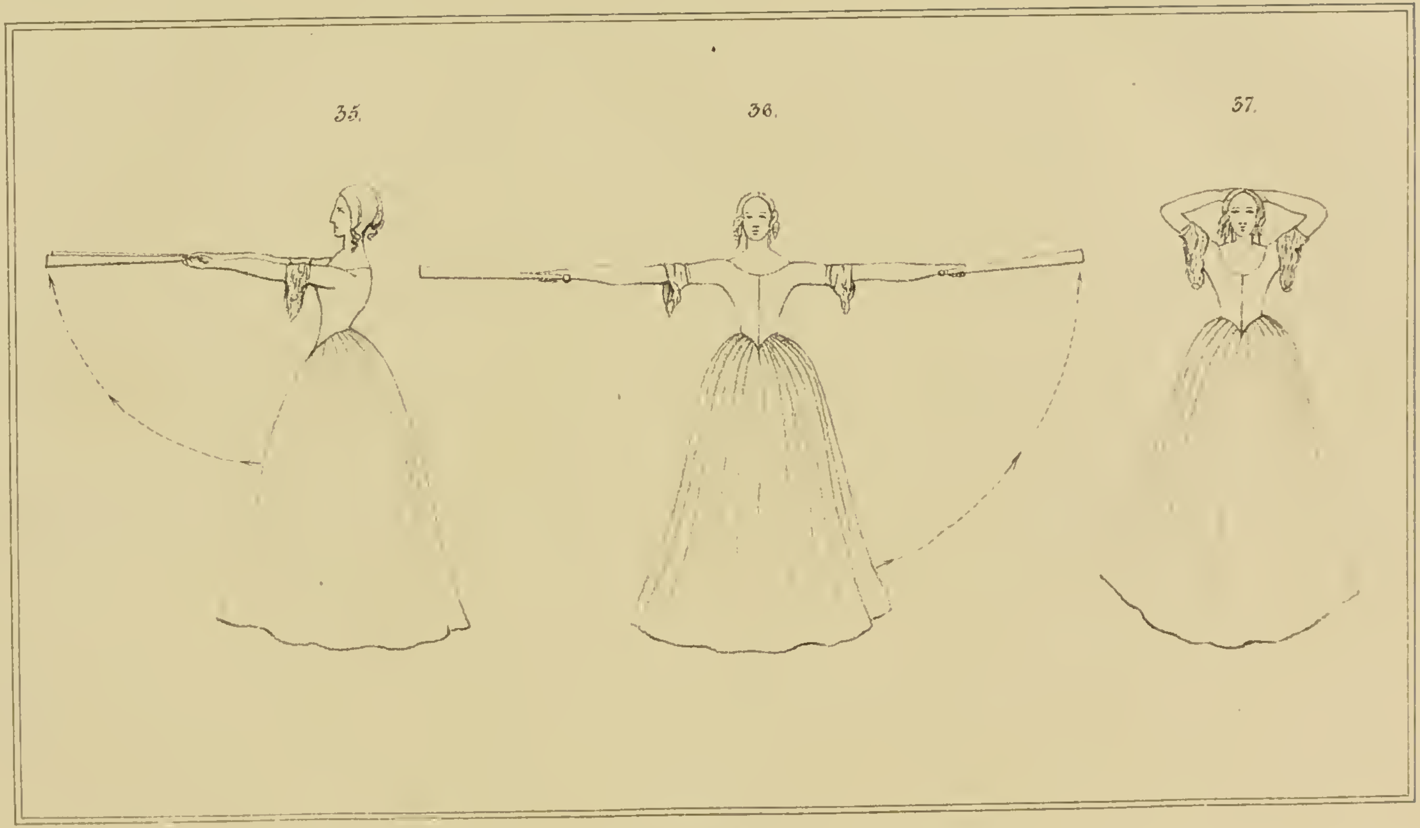

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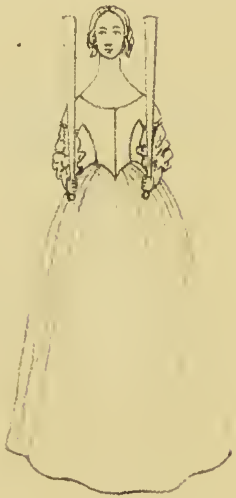

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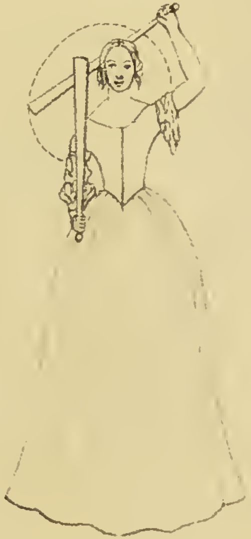


Exercises.

side alternately is made on the heels. The difference is, that both clubs are slid over the shoulders at once; that the face is not turned sideways, so as to look over the wrist, but simply thrown backwards as shown in Figure XXXIV; and that both clubs are gradually drawn back to their original places, as the turn is made to the opposite side.

The Third exercise begins from the position shewn in Figure XXXIII. The clubs are first thrown forward, as represented in Figure XXXV; three circles are next made in the direction indicated by the darts along the line in the same figure; they are then thrown in a still larger circle to the same side, as in Figure XXXVI, and sweep down in front of the feet (the body turning at the same time on the heels); and lastly, they may thus shoot over the shoulders, as shown in Figure XXXVII; the velocity gradually increasing, as in the two preceding exercises.

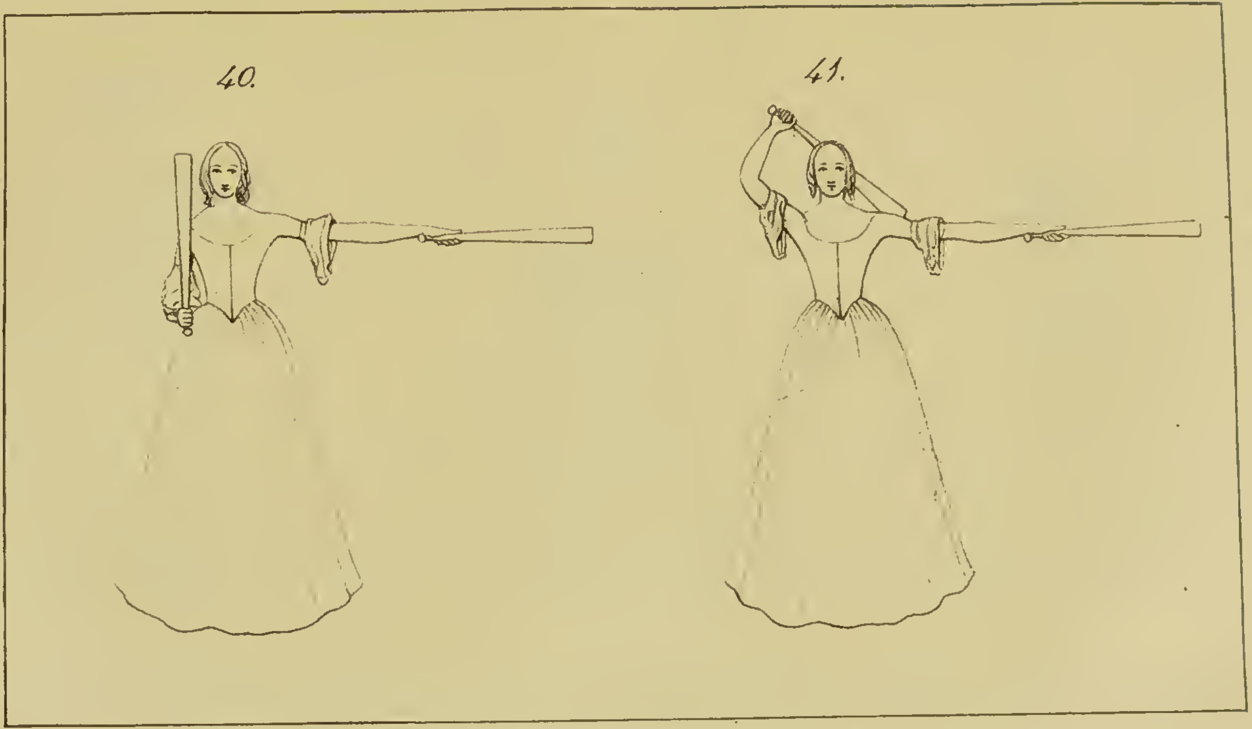
The Fourth Exercise commences from the position given in Figure XXXVIII, with either hand. If with the left, for example, the club in that hand is raised in a circular direction over the head and right shoulder, passed as deeply as possible behind the back, as in Figure XXXIX., and again brought up over the left shoulder to its original position. The point of the club should form an almost perfect circle, as represented by the lines in the same plate. This is done by each hand alternately.

The commencement of the Fifth Exercise is similar to the last; but, when the club has been passed round behind the head and shoulders, as in that exercise, instead of being brought over the shoulder to its original position, it is passed out laterally at arm's length, on a level with the height of the shoulders, as in Figure XL; it is then brought back again to its original position; and the same is done with the other hand.

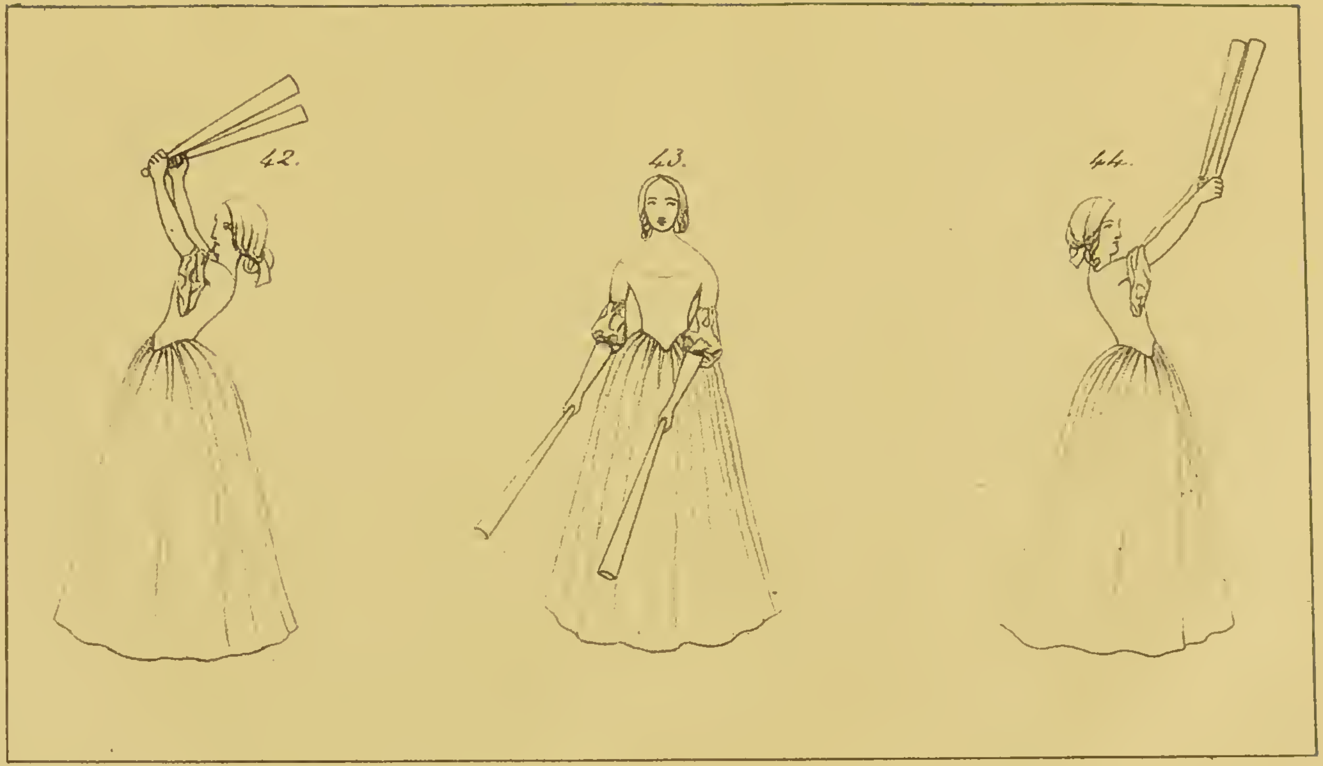
The Sixth Exercise is founded on the last described. The difference is, that while one hand is holding the club horizontally out, the other is performing the circle round the head and shoulders. This is made sufficiently clear in Figure XLI.

In the Seventh Exercise, the clubs are thrown out laterally, to the right for example, at arm's length, as represented by Figure XLII; sweep in a large circle downward past the feet, as in Figure XLIII; then up again on the left side till they arrive nearly at the place from which they moved, as in Figure XLIV. After this (but without checking the action), the left club performs a smaller circle round the head and shoulders, precisely similar to that in the fourth exercise, only that it is commenced with the left hand in a more elevated position; and the right hand at the same time performs a circle as nearly parallel to it as possible, round the right shoulder. The clubs are then thrown out to the right in the same manner; and so on alternately.

The eighth Exercise is founded on the seventh, in the same manner as the sixth is derived from the



Exercises.



Exercises.

fifth. Thus, while one club, the left, for example, performs the large circle, the right makes the smaller one round the head and shoulders, and is then thrown out to the left side, while the left makes the smaller circle; and so on. This exercise is very beautiful when performed with ease and correctness. There must be no stop between the greater and smaller circles.

Swimming has been justly placed in the first rank of gymnastic exercises, calculated to establish regular configuration, and to correct those which present some defects. This exercise has been extolled by eminent men, such as Portal and Delpech, who have assigned to it especial advantages in the treatment of deviations of the figure; and happy results have often been obtained from it. In this exercise, the body of the person who has lost symmetry of form, in consequence of lateral curvature, cannot, according to the laws of hydrostatics, maintain its balance in the water, on the face, without the superior and inferior extremities, which correspond diagonally with the concavity of each curvature, increasing the energy of their contraction; and the result is to straighten the spine, and restore the symmetry of the thoracie cavity; for otherwise the right side of the chest, being more developed than the left, and the left hip more voluminous than the right, the body could not repose equally on its anterior plane.

CHAPTER IV.

TREATMENT OF DORSAL CURVATURE.

The exercises which may be rationally adopted, for the cure of lateral curvature in the dorsal region, with hope of success, are all those which tend to encrease the power of the muscles connecting the lower shoulder with the spinal column, and consequently contracting in a direction diametrically opposed to the line in which their antagonists have acted unfavourably.

The straightening of the spinal column curved in this way is frequently effected by making the patient carry on the arm of the side towards which the body leans, and consequently the side corresponding to the concavity of the curvature, a weight so heavy that not being able to support it long by the mere power of the muscles of the arm, the body may be greatly inclined towards the free side, in order to maintain itself in a state of equilibrium necessary to standing, so that the centre of gravity of the body may be made to pass as much as possible between the chest and the weight, and the latter find support from the hip.

Another exercise has also been recommended as calculated to correct deviations of the figure,—the action of raising a weight by the assistance of a cord which passes over a rolling pulley, fixed in the ceiling of the room, and put in motion by the arm corresponding to the depressed shoulder.

A third and very simple means of conveniently putting in action these muscles, is to engage the hand on the concave side in turning a winch, fixed in a wall, or on something corresponding to the height of the shoulder, in a vertical direction. The handle of the winch ought to be so long that the patient may extend the arm as much as possible, when the hand is arrived at the most elevated part of the circle which it describes.

To derive all the good which may be expected from this exercise (which may be modified at pleasure according to various circumstances), it is of the utmost importance that the chest of the young person should be freed from all constraint, and enjoy all possible liberty; otherwise not only would the muscles of the arm and shoulder, being constrained in their motions by stays, be developed but slowly and imperfectly, and make contractions but weakly felt by the processes of the vertebræ in which they are inserted; but we should also see the vital power, and consequently the physical development, thrown more particularly upon the muscles bordering the sub-spinous edge of the shoulder-blade, which receive no other pressure than the strap of the stay (generally weak enough), and which acting especially on the cervical vertebræ, would not draw the column in the direction in which it is desirable that the united contractions of the majority of the muscles put into motion should act.

This exercise presents, besides the straightening of the column, the undoubted advantage of singularly favouring the regular development of the chest. The muscles, which go from the ribs to the arm and shoulder, being in an almost constant state of contraction, a part of their power necessarily acts on the elastic walls of the chest, draws them outwards, and patients are often seen whose chests, being very narrow, have not allowed of sufficient development of the organs of respiration, but who rapidly acquire a regular conformation by exercising the two arms together, by means of two winches placed opposite to each other. Of course, these means ought not to be neglected under circumstances, which require frequent variation of exercises, nor in cases where they cannot all be conveniently or suitably employed.

When the right lateral curvature of the dorsal region is, as frequently observed, complicated with inclination of the head forwards, we may, in order to counteract effectually this double deformity, employ an exercise which forms part of the ordinary games of childhood, and which agrees particularly with young girls. This exercise is that of the shuttlecock, at which the patient ought to be accustomed to play with the left hand. The continual action of the arm of this side will powerfully contribute to replace the column in its natural direction; and at the same time the repeated efforts which the young girl is obliged to make to raise the head, to follow the track of the shuttlecock, will make the muscles of the posterior and lateral parts of the neck acquire the power necessary to maintain the head upright.

This last exercise has this advantage over the former, that, leading young people to muscular action by the allurement of pleasure, it requires not that constraint to which we are sometimes forced to have recourse, to make them submit to a methodical exercise, which to them is uninteresting as they do not foresee the result. Keeping also the organs of the voice in continual action, by the joyful and animated conversation which the game produces, it concurs, according to the judicious remark of Londe, effectually to expand the chest, and regulate the function of the lungs.

We may also make use, with much benefit, of the ordinary seesaw in lateral deviations of the spine: only, instead of placing the patients astride, at the two extremities of the seesaw, they should be kept standing, and maintain themselves in that position by two cords fixed to the ceiling and provided with handles. The cord which corresponds with the depressed shoulder ought to be placed a little higher than the other, in order that the suspension of the body at each descent of the cross-piece, may be effected principally by that arm, and thus act more favourably on the curvatures of the spine.

CHAPTER V.

TREATMENT OF LUMBAR CURVATURE.

The various exercises which have been described, are sufficient in many cases to correct the deformity for the remedy of which they are employed; but when the deviation is such that the curvature of the dorsal region is accompanied by a well marked inverse curvature of the lumbar region, we may for young men (for young women, the Indian exercises suffice) be almost always sure of deriving advantages from fencing practised with the hand corresponding to the concavity of the dorsal curvature. We may prove this by reducing to clear and precise data the amount of action which the muscles exercise over the spinal column in the different movements and positions which compose that exercise.

When, as is seen from what precedes, a curvature of the spinal column is occasioned by muscular action, and we have well determined the mechanism of that action, it is almost always easy to find an exercise which will put into action the muscles by defect of which the equilibrium is disturbed.

Being obliged to speak in general terms, the preceding observations have been confined as much as possible to the exact function of the muscles of which it is necessary, in each principal kind of curvature, to favour the development, and some examples have been given of the different kinds of exercises which may in each instance serve the requisite purpose. But it will be easily conceived that the practitioner who is acquainted with the theory of motion, who is versed in short in the laws of animal mechanism, may vary the exercises ad infinitum, and modify them in practice, according to numerous circumstances which it is difficult to point out in theory.

Exercise, to be productive of full benefit, must be taken under certain conditions: thus, it is always prejudicial immediately after a meal; and it is much more beneficial when the person enjoys it in a place large, open, and exposed to the action of the sun. Warm baths, with slight rubbing of the limbs and joints, will soon destroy the pain by which exercise may have been accompanied in the first instance; at the same time that they will dispose the muscles to act next day with more power and less fatigue.

To endeavour to straighten by exercise the spinal column drawn out of its position by the irregular action of certain muscles, is indeed the chief object to be attained in the majority of cases ; but, in many instances, it is necessary to join to this every thing which is favourable to the general development of the constitution of the patient, and to correct the general state of languor which has predisposed to the disease.

Thus, besides the precaution which will be adopted from the commencement of the deformity, to make the patient lie on a solid and perfectly horizontal bed, she must have animal diet, principally composed of broiled meat, and a very moderate use of generous wine, if there are no symptoms of intestinal irritation, and if the organs of nutrition are in a healthy state.

PART IV.

DEFORMITIES OF THE RIBS AND STERNUM.

CHAPTER I.

LATERAL COMPRESSION.

Dr. Copland says that his experience leads him to state, that this deformity generally comes on gradually after birth, owing to deficient inflation and development of the lungs, arising from the weakness of the muscles of inspiration, and the flexibility of the ribs at the time of birth; that, in cases of this description, the vital energy of the lungs is insufficient for their healthy action, and the respiratory mechanism, unable to accomplish their full expansion, or sustain the continued pressure of the atmosphere, before which the soft and imperfectly-formed thoracic parietes gradually yield; and that it has appeared to him very frequently to be greatly increased, if not altogether occasioned, subsequently to birth, by the very common practice, among nurses, of lifting the child by pressing the palms of the hand on the sides of the chest, immediately under the armpits.

The same cause is assigned by Dr. Barlow, in the Cyclopædia of Practical Medicine.—" There is one very common mode of exercising infants; which, we think, deserves particular notice—we mean the practice of hoisting or raising them aloft in the air. This practice is of such venerable antiquity, and so universal, that it would be vain to impugn it. The pleasure, too, which most children evince under it, seems to show that it cannot be so objectionable as a cursory observer would be disposed to consider it. Still there are hazards which ought not to be wholly overlooked. The risk of accident is one of some amount: children have slipped from the hands, and sustained serious injury. Some people are so energetic as to throw up children and catch them in descending. This rashness there can be no hesitation in reprobating, for however confident the person may be of not missing hold, there must ever be risk of injury from the concussion suffered in the descent, and even from the firmness of grasp necessary for recovering and maintaining the hold. The motions of the body, too, have a direct tendency to induce vertigo; and when the liability of the infant brain to congestion and its consequences is considered, when the frequency of hydrocephalus in infants is borne in mind, an exercise which impels blood to the brain will not be regarded as wholly insignificant. There is one more objection which seems not to have attracted attention. The hold taken of a child in the act of hoisting it, is by the hand grasping the chest. The fingers and thumb placed on each side of the sternum, compress the ribs, and any one with the hand so placed will at once perceive that if the pressure were strong, and the resistance from the elasticity of the ribs weak, the impression on the chest resulting would correspond exactly with the deformity named chicken-breast. That any force is ever used, capable of inducing speedily such a change, is in the highest degree improbable; but that reiterated pressure of this kind, however slight, would, in a weakly child, have power to impress and distort the chest, few, we imagine, will doubt."

In this deformity, observes another writer, the sides of the chest are much flattened, one being sometimes more depressed than the other; the ribs occasionally appear even as if driven inward, from one side to the other; and, in some children, the compression is such, that both sides of the chest can be grasped with the fingers of one hand. The sternum consequently projects in a carinated form, or like the breast of a pigeon, whence persons with this deformity are called pigeon-breasted.

"There is always at the same time some alteration in the natural direction of the spinal column; either

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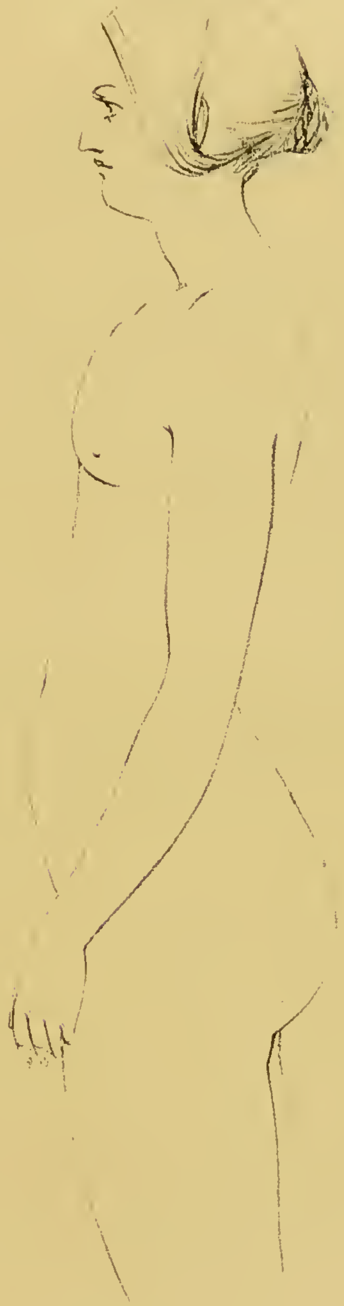

Projecting Sternum.

a lateral curvature, or a projection of the spine backwards.

"While thus the transverse diameter of the chest is of course considerably lessened, the antero-posterior and vertical diameters are increased; so that while the former loses a fourth, a third, and sometimes half of its extent, the others receive a proportionate increase.—(See Figure XLVII).

"This contracted state of the chest is unfavourable to the proper development and exercise of the organs contained in it, and their functions are consequently deranged. The extent of this derangement depends mainly on the extent of the deformity.

"If no attempt be made to remedy the deformity at an age when the bones are in a pliant state, the patient, sooner or later, falls a sacrifice to some disease of the lungs, or heart, produced or excited by the constant functional derangement to which these organs have been subject."

CHAPTER II.

ANTERIOR COMPRESSION.

Pressure upon the anterior part of the chest is generally the cause of this deformity.

That pressure which arises from the useful pursuits of life, is well illustrated by the invaluable work of Mr. Thackrah, on "Arts, Trades and Professions, as affecting Health and Longevity."

"Milliners, dressmakers and straw-bonnet makers, are often crowded in apartments of disproportionate size, and kept at work for an improper length of time. Their ordinary hours are ten or twelve in the day, but they are confined not unfrequently from five or six in the morning till twelve at night. The bent posture in which they sit tends to injure the digestive organs, as well as the circulation and the breathing. Their diet consists too much of slops, and too little of solid and nutritive food. From these causes collectively, we find that girls from the country, fresh-looking and robust, soon become pale and thin Pains in the chest, palpitation, affections of the spinal and ganglionic nerves, and defect of action in the abdominal viscera, are very general. The constant direction of the eyes also to minute work affects these organs. Sometimes it induces slight ophthalmia, and sometimes, at length, a much more serious disease, palsy of the optic nerve. The remedies are obvious—ventilation, reduction of the hours of work, and brisk exercise in the open air. The great cause of the ill-health of females who make ladies' dresses, is the lowness of their wages. To obtain a livelihood, they are obliged to work in excess.*

"The employment of young children in any labour is wrong. The term of physical growth ought not to be a term of physical exertion. Light and varied motions should be the only effort—motions excited by the will, not by the task-master—the run and the leap of a buoyant and unshackled spirit. How different the scene in a manufacturing district! No man of humanity can reflect without distress on the state of thousands of children, many from six to seven years of age, roused from their beds at an early hour, hurried to the mills, and kept there, with the interval of only forty minutes, till a late hour at night; kept, moreover, in an atmosphere impure, not only as the air of a town, not only as defective in ventilation, but as loaded also with noxious dust. Health! cleanliness! mental improvement! how are they regarded? Recreation is out of the question. There is scarcely time for meals. The very period of sleep, so necessary for the young, is too often abridged; nay, children are sometimes worked even in the night. The time of labour in the flax-mills is generally excessive. When the former edition of this work was published, the people were working from half-past six in the morning till eight at night, and were allowed an interval of but forty minutes in all that time. The engine was stopped only at noon; and the operatives consequently were obliged to take breakfast and 'drinking' (afternoon meal), while they pursued their labour,—one tending the other's machinery while the latter took his hurried meal. Children sometimes have not had the opportunity of eating till nine or ten A. M., though they had been at the mill from half-past five, and must have risen from their beds half or three quarters of an hour before. At the present time, the work commences at six and ends at half past seven; the intervals for meals are fifteen minutes, forty, and fifteen, and the children and overlookers are allowed to leave the mill only for dinner. Whatever improvement may be effected without a legislative enactment, restricting the period of labour, this improvement will be but temporary. Masters, however enlightened and humane, are seldom aware, never fully aware, of the injury to health and life which mills occasion. Acquainted far less with physiology, than with political economy, their better feelings will be overcome by the opportunity of increasing profit, and they will reason themselves into the belief, that the employment is by no means so unhealthy as some persons pretend, and that the children will be nothing the worse for two or three half-hours a day more labour, and a little less time for meals. That this is no improbable prognostic, is proved by the past. The diminution of the intervals of work has been a gradual encroachment. Formerly an hour was allowed for dinner; but one great manufacturer, pressed by his engagements, wished his work-people to return five minutes sooner. This abridgment was promptly adopted at the other mills. Five minutes led to ten. It was found also that breakfast and 'drinking' might be taken while the people were at work. Time was thus saved; more work was done; and the manufactured article consequently could be offered at a less price. If one house offered it at a lower rate, all other houses, to compete in the market, were obliged to use similar means. Thus, what was at first partial and temporary, has become the established period; and the unfortunate artisans working before in excess, have since had to carry labour to a still greater and more destructive extent. The sound of the steam-engine anticipates, often, the cock-crowing of the morning. While the engine works, the people must work. Men women and children, are thus yoke-fellows with iron and steam; the animal machine—fragile at best, subject to a thousand sources of suffering, and doomed by nature, in its best state, to a short-lived existence, changing every moment, and hastening to decay—is matched with an iron machine insensible to suffering and fatigue; all this, moreover, in an atmosphere of flax-dust, for twelve or fourteen hours a-day, and for six days in a week."

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* "Two very respectable dressmakers, who charge more than the generality, state that they can earn but twelve shillings each per week, though they sew, on the average, fifteen hours per day. The sempstress who goes out to her work rarely receives more than a shilling a day, in addition to her board. Can ladies, humane in disposition, and prompt in their support of charitable institutions, reflect on the miserable hire they afford to the persons they employ—persons of their own sex—persons often reduced, by the faults or misfortunes of others, from a comfortable situation in life, and sometimes even from apparent independence, to work for daily bread?"

In schools "children, and very young children too, are kept for many hours daily, in a state as nearly motionless as it is possible for the masters to produce. The time devoted to amusement is much too little. Instead of two or three hours a-day being allowed for play, only two or three hours a day should be devoted to confinement and labour. To fix a child in a particular posture for hours, is vile tyranny, and cruel restraint on nature. To girls' schools, in particular, should attention be paid. The exercise is much too limited. Young ladies walk out, it is true, but scarcely at a rate to warm the feet. Their time for amusement is too little; and full romping exercise, exercise which brings all the muscles into play, is discouraged. It is vulgar to use the limbs as nature designed; it is vulgar to take the food which nature requires; and young ladies must not do any thing that is vulgar. Sitting, moreover, for hours at needle-work, or in learning what are called accomplishments, they leave a numerous class of muscles wasting for want of exercise. The muscles of the back are especially enfeebled; and the spinal column, in youth comparatively soft and flexible, bends under the weight of the head and arms. The spine yields, because the muscles, which closely connect the bones, and should by their action keep them in a proper line, become too weak. We are often asked, why are spinal complaints so common? We answer, that a principal cause is the want of full exercise; we say that young persons are obliged to acquire what is of little or no use in after-life, while they neglect what is necessary to the establishment of the body in health and vigour; in short, we have daily to lament that muscular exercise is sacrificed to accomplishments and to learning. If it be asked, why are girls more subject to distortion than boys? We reply, because they do not romp like boys. The amusements of boys are far more active than sedentary; those of girls are more sedentary than active. When girls leave school, the same system of muscular quietism is enforced. They must keep up their accomplishments by practice. Several hours a-day they must devote to music, and frequently a considerable time to the more injurious occupation of drawing; most of the remaining day, they spend in finger-occupations. Little time is devoted to exercise in the open air, and the exercise they do take is such as to chill, rather than invigorate the circulation."

Literary men, students, clerks, and all whose occupations require them to stoop, and who do not counteract this habit by proper exercise, are more or less subject to the hollow sternum.

The pressure of stays, and that of busks in particular, appears to be a great cause of the occurrence of this deformity among women.

"The external appearances of the chest in this kind of deformity are the reverse of those which we last considered. The sternum is concave or hollow anteriorly, being pressed inwards, either at its middle, at its lower part, or along its whole extent; the sides of the chest are prominent; the shoulders are high; and the spine is either straight, or but little altered from its natural shape. (See Figure XLVIII).

"Internally, the lungs and heart are of course compressed anteriorly; their functions are correspondingly altered; and their structure ultimately suffers.

"Affections of the stomach, however, are more prevalent in this deformity than those of the chest."

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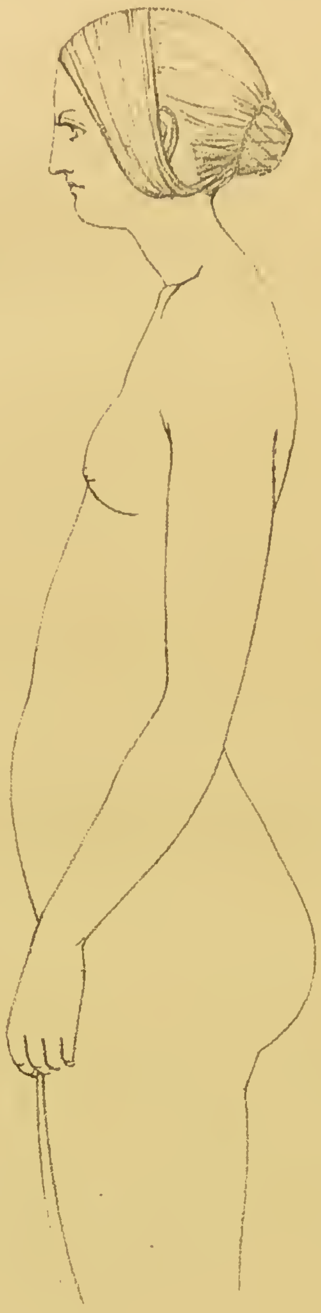

Anterior Compression

CHAPTER III.

TREATMENT OF THE DEFORMITIES OF THE CHEST.

HERE both local and constitutional means are expedient; and whatever mode be adopted, a pure air is requisite to its success. I trust, however, to other than constitutional remedies.

Dr. Copland has observed, that "in this deformity, the various exercises resorted to with the view of imparting strength and agility to the frame, will be useful, if judiciously directed;" that "as soon as children affected by this depression of the walls of the chest can be brought to employ the muscles of the upper part of the body in a determinate manner, this mode of treatment should also be employed."

With Dr. Copland, Dr. Birkbeck, Mr. Coulson, and others, I deem the Indian Exercises, first described in Europe by Donald Walker, in his "Exercises for Ladies," as greatly preferable to all others, both in these and in every other deformity of the chest.* They raise up the ribs and sternum, without the slightest counteracting tendency to depress them, and they give the fullest expansion to the chest.

"By these means, if properly persevered in, the chest returns to its natural shape, and the whole system becomes invigorated. It is evident indeed that whatever both raises and expands, or naturally rounds, the chest, at once elevates the depressed sternum, and depresses the elevated one.

Having shown, from Mr. Thackrah's valuable work, in what way students and literary men suffer from a sedentary and bending position, I here quote his observations on the treatment which is necessary;—

"The evils attendant on literary and scientific pursuits, may be greatly diminished by measures of a very simple, though decided, character.

"1st. The quantity of study should be reduced. It should engage but a moderate and definite proportion of the day. Three or four hours, I think enough for close reflection—others, perhaps, would allow a longer period; but six hours certainly ought not to be exceeded; for more cannot be employed with effect. We hear, indeed, of men reading or writing twelve or fourteen hours a-day. They may be at their books during this time, but I doubt their being engaged in study. The faculties cannot support such exertion. The mind and body require relief and alternation. Change is the character of the universe. Every thing has its rise, acmé and decline; and man is subjected to this law, alike in his physical and intellectual character. The mind, long applied, loses its power. As Milton feelingly remarks, 'The spirit of man cannot demean itself lively in this body, without some repeated intermissions of labour, and serious things.' Constant application renders the ideas confused, and stops invention. The brain may then be said to be strained rather than exerted, and its work is aptly said to smell of the lamp. Let the student bear in mind that, even without reference to health, long continued application of the mind is unwise. He defeats his object by the earnestness with which he pursues it. Let him remember the remark of Pope Ganganelli. 'There is scarcely any book which does not savour of painful composition in some part of it; because the author has written when he should have rested.' Nor is temporary failure all. I have before adverted to the serious effects on the brain and its membranes, which result from excessive application of mind. Let me again urge the student to remember that exhaustion is the result of great exertion, that the finest intellect and powers which mock difficulty, and ridicule opposition, are often broken by their own intensity of action. Nothing surely is more melancholy than the view of high-wrought talents sinking into torpor and night-shade encircling the brow, which should have worn the chaplet of laurel. Alternation of pursuit affords some relief. But this principle cannot be a substitute for rest, still less can it be a substitute for that muscular exercise in the open air, which is the

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* It is essential that every reader interested in this subject should possess the important work now quoted, and practise the exercises which it prescribes.

"2nd measure.—This remedy, indeed, is as obvious as the first, and yet quite as much neglected. By muscular exercise, I do not mean a walk at the rate of a funeral procession; or a ride on horseback, at the pace of a market woman: I mean such exercise as healthy boys take when liberated from the school-room, or as sportsmen take when in pursuit of game—exercise which produces full circulation, and a free state of skin. The gymnastic practice is highly to be commended.* Gardening is also a valuable recreation, and one which may be used when the age for more strenuous exertion is past.

"A third remedy, to which I have more than once adverted in other classes, and which, from its importance, I would enforce, though at the risk of repetition, is attention to the state of the digestive organs, and especially to the time and mode of eating. When food is taken at irregular times, and in a hasty manner, the stomach must suffer. The gastric juice is not constantly secreted; and the period of its abundance is determined by the habits of the person. If a man, accustomed to dine or lunch at two, defer the meal till five, he finds his appetite and power of digestion to be less. In fact, the stomach secreted gastric juice at its usual period; but, receiving nothing for this solvent to act on, was obliged to absorb it, and was not able to effect a fresh production equal in quality and quantity to the former. The meals, then, should be taken at regular and accustomed hours. We are far from approving of frequent meals; they do not allow sufficient rest for the stomach. Still less should food and study be so mixed together, as to leave no time for digestion. The quantity of food should be considerably less than usually taken. This rule is of more importance than a reference to quality. Some literary men have been in the habit of taking vinous or spirituous liquors; but this practice is decidedly injurious. The intellectual excitement it produces at the time, is more than counterbalanced by the subsequent depression; and ruin of health, and the abbreviation of life, are the ultimate results. Tea and coffee are much better and safer stimulants: they have been highly prized by Harvey, Pope, Voltaire, Napoleon, and others. Their moderate use may be commended, but the student should be informed, at the same time, that their abuse—the drinking, I mean, of tea and coffee of great strength, or several times a day—decidedly impairs the tone of the stomach. Fermented liquors are injurious. The state of the intestines is important. When these are neglected, the digestive functions are impaired, and a train of bodily evils necessarily succeeds. The mental faculties are, in many persons, affected even immediately by the state of the bowels.

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* "He who vehemently applies himself to the mathematics, or to any other dianöetic exercise, should also employ the motion of the body, and be familiar with the gymnastic."—Taylor's Plato. Hippocrates, though delicate in constitution, acquired health by the practice of gymnastics, and attained the age of 100.

"As pure air is important to the student, the country is of course preferable to towns. I may repeat, also, the general recommendation of morning, as the best time for mental application. When there is much excitement and continued labour, the frequent washing of the head with cold water affords great relief, and tends to prevent that irregularity in the circulation, on which is founded disease of the brain."